



# CONDENSED CATALOGUES OF MECHANICAL EQUIPMENT

WITH  
GENERAL CLASSIFIED DIRECTORY  
AND  
ENGINEERING DATA SECTION

SEVENTH ANNUAL VOLUME

1917

THE AMERICAN SOCIETY *of*  
MECHANICAL ENGINEERS

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# **CONDENSED CATALOGUES OF MECHANICAL EQUIPMENT**

**With  
MECHANICAL EQUIPMENT DIRECTORY**

**Engineering Data from recent publications  
of the Society are included**

**SEVENTH ANNUAL VOLUME  
OCTOBER, 1917**

↓  
★ **THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS**  
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NEW YORK**



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## PREFACE

**T**HE Seventh Annual (1917) volume of A. S. M. E. Condensed Catalogues of Mechanical Equipment is here placed at the service of the membership of the Society, and of the mechanical engineering profession at large.

The striking increase in the size and comprehensiveness of this edition of the Condensed Catalogues will be immediately apparent. Many more firms than ever before are represented by publication of their data in the Catalogue Section; and it is worthy of remark that among them are a large proportion of the leading firms in their respective lines.

The general Mechanical Equipment Directory, which was inaugurated as a new and distinctive feature in the 1916 volume, appears in this edition in enlarged and improved form. In its preparation the suggestions received from members and others, following the initial appearance of the Directory in the issue for last year, have been of much assistance. During the past year, the Society's records relating to manufacturers of mechanical equipment have also been extended, with the result that in this edition the Directory contains the names and addresses of more than 3200 different firms, indexed and cross-indexed under upward of 2500 subject headings.

Beyond question, the great increase in the number of catalogue pages in this edition is mainly due to the enlargement of the scope and reference value of the volume, brought about by the inclusion of the general Mechanical Equipment Directory, in which all eligible manufacturers are entitled to listing of their products free of charge within reasonable limits, and without obligation to use space. The success of this policy, involving as it did a new departure among publications of this class, has made it possible to meet the considerable additional expense of compiling and publishing the Directory Section, while the cost of publication of catalogue data has remained unchanged at the rate of seventy dollars a year for one page and fifty dollars for each additional page.

The section of Engineering Data has also been extended and improved in this volume. In addition to the data selected from the Journal and Transactions for the past year, a summary is now included covering Standards relating to equipment and processes, as formulated by committees of the Society.

Announcement is also made of the inclusion in this volume of another new reference feature, in the form of a classified Directory of Consulting Engineers, compiled from the membership of the Society. It is believed that in its initial form this list will prove extremely valuable, and every effort will be made to enlarge still further its scope and usefulness.

With the extensions and additions outlined above, this volume is offered to the mechanical engineering field in the belief that it will render a peculiar service in the establishing of a closer buying and selling relation between the user and maker of mechanical equipment.



**NOTE.**—All data presented have been edited with a view to the elimination of advertising claims or exaggerated statements and every effort made to restrict the Condensed Catalogues to firms of good standing only. Publication of catalogue data does not constitute in any sense an endorsement by the Society of the firms or products thus represented.

*Extract from Constitution: C 55. The Society shall not be responsible for statements or opinions advanced in papers or in discussions.*

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**CATALOGUE SECTION  
PART I**

**Power Plant Equipment**

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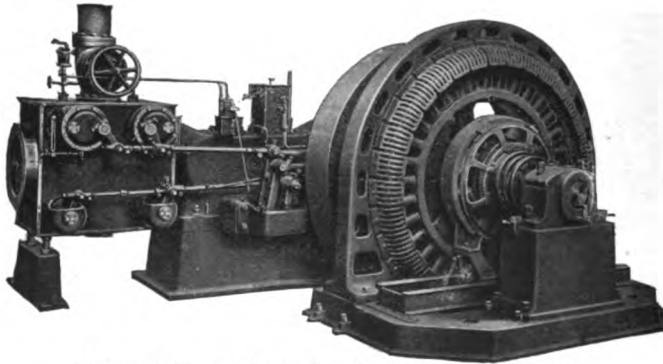
## **BALL ENGINE CO.**

**ERIE, PENNSYLVANIA**

**Builders of Corliss-Valve and Single-Valve Engines; Horizontal and Vertical Side-Crank Engines; Tandem- and Cross-Compound Single-Valve Engines, Corliss-Valve Compound and Single-Cylinder Engines**

### **BALL HIGH-SPEED CORLISS ENGINES**

The feature which distinguishes this engine from other four-valve shaft-governed engines is the patented non-detaching valve gear, which imparts the same movement to the valves that the drop cut-off of the slow-speed Corliss produces by picking up and dropping them. This permits the use of the best form of valve, and the valves are given the movement necessary for the greatest durability and tightness.



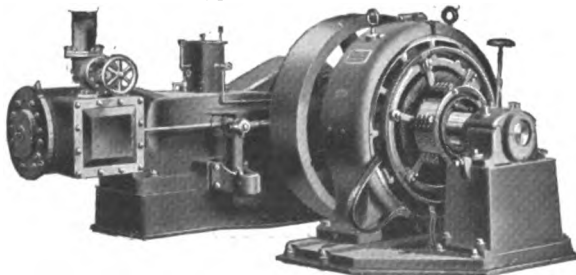
Horizontal Single-Cylinder Side-Crank Engine—Corliss Type

Built in sizes from 100 H. P. to 1600 H. P. in the single-cylinder and cross-compound types.

These engines excel in economy and regulation and are especially adapted for electric service.

### **BALL SINGLE-VALVE AUTOMATIC ENGINES**

These engines are the result of a long experience in building engines for electric service. They are superior in design and construction. The regulation and economy are the best of their type.



Single-Cylinder Side-Crank Engine—Single-Valve Type

Built in sizes from 25 H. P. to 800 H. P. in the single-cylinder tandem-compound and cross-compound types.



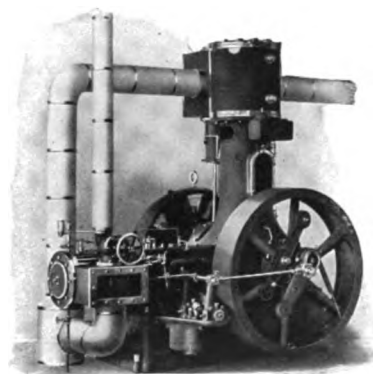
# BOUND BROOK ENGINE & MFG. CO.

WORKS: BOUND BROOK, N. J.

PHILADELPHIA OFFICE: 1425 CHESTNUT ST.

Manufacturers of "American-Ball" Steam Engines, Marine Steam Engines

## THE AMERICAN-BALL ANGLE COMPOUND ENGINE



The American-Ball Angle Compound Engine has all of the advantages possessed by every American engine, an automatic system of lubrication, sensitive balanced automatic governor, adjustable cross-head guides, attached indicator reducing motion, high-class workmanship, etc. Besides these, some of the special advantages inherent to the angle construction are as follows:

With the cylinders at right angles, practically perfect balancing is secured. The angle construction, with its four impulses per revolution, gives a practically uniform torque, making this engine especially adaptable for driving alternators which are to be run in parallel. Small floor space. The Angle Compound Engine gets twice as

much power on the same amount of floor space as does a simple engine.

## DIMENSIONS OF AMERICAN-BALL ANGLE COMPOUND ENGINES

### FOR DIRECT-CONNECTED SERVICE

K. W.	Cylinder Diameters and Stroke	Revolutions per Minute	Floor Space		Steam and Exhaust Pipes		Shipping Weight in Pounds
			Length	Width	Steam	Exhaust	
75	12 & 19 x 10	325	103	107 1/2	4	6	12,200
100	13 & 20 x 11	300	111	112	4	7	15,200
150	16 & 25 x 12	285	125	120 1/2	6	9	21,400
200	18 & 28 x 14	260	138	132 1/2	6	10	27,900
250	20 & 32 x 15	250	145	156 1/2	7	12	31,700
300	22 & 34 x 16	240	154	165	8	12	39,200
400	25 & 38 x 18	225	164	174	9	14	51,000

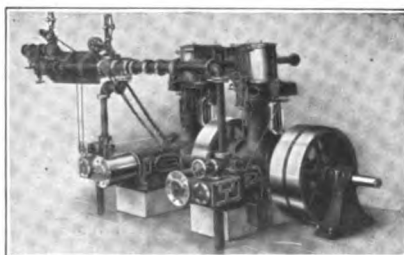
## THE AMERICAN-BALL FOUR-CYLINDER PAPER MILL ENGINE

has the following important advantages:

A speed range of 8:1 and even 10:1, permitting of direct connection to the variable speed shaft.

Elimination of shut-downs to change speed.

Excellent speed regulation secured by the four-cylinder construction of the engine and by a special stabilized governor which prevents surging in speed and insures even thickness of paper.



Ask for literature on Paper Mill Engines and Engines for Isolated Plants, also our report on cost of Isolated Plant Power.



# THE FITCHBURG STEAM ENGINE CO.

Established 1871

FITCHBURG, MASS.

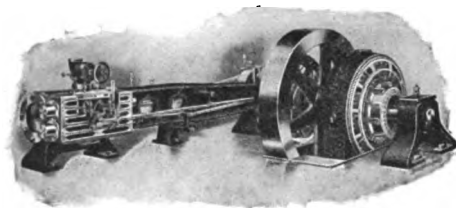
NEW YORK  
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Manufacturers of Steam Engines for Use under Every Sort of Condition

## "THE FITCHBURG"—DIRECT-CONNECTED—GIRDER BED

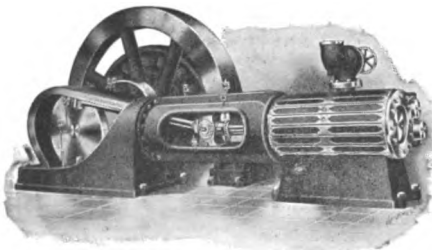


Sizes 7' by 18' to 22' by 42'. Revolutions 80 to 250.

D. Con. or Belted Girder Bed as above	To 300 H. P.
" " " " Tangye Bed as below	" 800 "
" " " " Tandem Girder	" 300 "
" " " " Tandem Tangye	" 800 "
" " " " Cross Girder	" 750 "
" " " " Cross Tangye	" 1500 "
" " " " High-Speed Horizontals	" 250 "
" " " " Single Cylinder Vertical	" 400 "
" " " " Steeple Comp'd Vertical	" 400 "

Details for any size given on application. *Mention Catalog W.*

## "THE FITCHBURG"—DIRECT-CONNECTED—TANGYE BED



Sizes 12' by 18' to 30' by 48'. Revolutions 80 to 250.

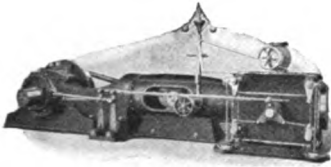
Also the Fitchburg-Prosser Engine. Better economy guaranteed with single cylinder than can be obtained from best compound engines under same steam conditions.

We have taken over the entire Engine business of the Putnam Machine Co., builders of the well-known "Putnam" Engine. Please send all inquiries to us.

# HARDIE-TYNES MANUFACTURING COMPANY

BIRMINGHAM, ALABAMA

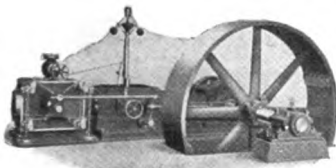
**Manufacturers of Corliss Engines, Hoisting Engines, Direct-Connected Engines,  
Slide Valve Engines, Air Compressors, Special Machinery, Heavy Castings**



## HEAVY DUTY CORLISS ENGINES

### Tangye Frame Type

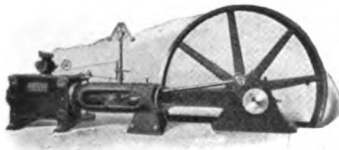
Designed for steam pressures of 150 lb. or more, to run at moderate speeds. Built in sizes ranging from 16 x 36 in., 114 i.h.p., to 34 x 60 in., 1255 i.h.p.



## HEAVY DUTY CORLISS ENGINES

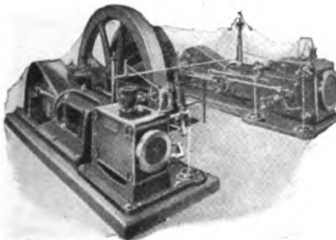
### Imperial Frame Type

These engines are also designed for steam pressures of 150 lb. or more, but may be operated at somewhat higher rotative speeds than the Tangye Frame Machines. Sizes range from 8 x 20 in., 21 i.h.p., to 22 x 30 in., 550 i.h.p.



## HEAVY GIRDER FRAME CORLISS ENGINES

These engines are especially suitable for manufacturing plants having moderate steam pressures and no suddenly applied overloads. Designed for steam pressures of 150 lb. or less, and built in sizes ranging from 12 x 24 in., 52 i.h.p., to 26 x 48 in., 780 i.h.p.



## COMPOUND CORLISS ENGINES

### Cross and Tandem Types

Are built on either Tangye, Imperial or Girder Frames. Sizes range from 400 i.h.p. to 2300 i.h.p., 65 i.h.p. to 700 i.h.p., 135 i.h.p. to 1300 i.h.p., respectively.

## DIRECT CONNECTED CORLISS ENGINES

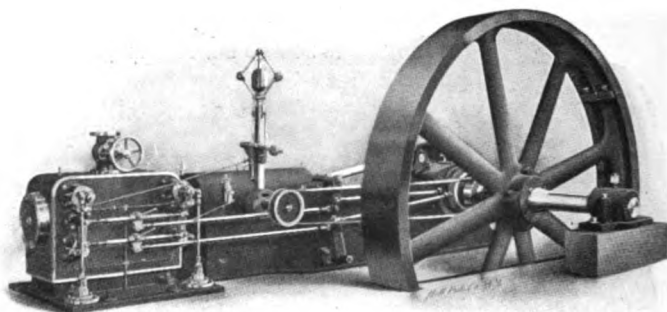
Are built on both Tangye and Imperial Frames for service with either direct or alternating current generators, from 50 to 1500 k. w. capacity.

## **HARRIS-CORLISS ENGINE AND MACHINE COMPANY**

**PROVIDENCE, R. I., U. S. A.**

**Builders of Harris-Corliss Engines. Remodeling and Repairing of Engines.  
Mill Repairs and Machine Work. Special Machinery. Lathes. Wood Rim  
Pulleys**

### **IMPROVED HARRIS-CORLISS ENGINES with Brown Patented Releasing Valve Gear**



**Valve Gear Side Simple Harris-Corliss Engine, Extra Heavy Duty Type**

The durability and economy of Harris-Corliss Engines are phenomenal. Second-hand units command good prices and are always in demand. When rebuilt they carry the same guarantees as new engines.

Built in all sizes from 50 to 2500 H. P.

### **REBUILDING AND REPAIRING ENGINES**

**Break-Down Jobs Given Special Attention**

**Mill Repairs, Shafting and Machine Work**

### **LATHES—WOOD RIM PULLEYS**

**Special Machinery Built  
To Order**



# SKINNER ENGINE COMPANY

ERIE, PA., U. S. A.

Branches in 32 Cities

Builders of High Grade Automatic Engines

## THE "UNIVERSAL UNAFLOW"



### THE MOST ECONOMICAL STEAM ENGINE EVER BUILT

Any engine will *operate* noncondensing and condensing; but the "UNIVERSAL UNAFLOW" is the only engine that will give *maximum economy* under both conditions, because it is

#### THE ONLY UNAFLOW ENGINE:

That operates noncondensing, as well as condensing, with *small clearances*.

That automatically changes, while in operation, from a condensing to a non-condensing engine, and *vice versa*, with changes of exhaust pressure, giving the maximum economy under both conditions.

That has expanding poppet valves which remain STEAM-TIGHT under all temperature and pressure changes.



This engine has demonstrated its economy over other makes of engines, and against outside current, in over one hundred power plants.

Built only  
Because Patented } by Skinner Engine Co.

Write for new catalogue

## THE VILTER MANUFACTURING CO.

1194-1196 CLINTON ST., MILWAUKEE, WIS., U. S. A.

Builders of Ice Making and Refrigerating Machinery, Corliss Engines, Poppet Valve Engines, Ammonia Fittings, Special Machinery, Etc.

### VILTER TANDEM COMPOUND POPPET VALVE ENGINE



Fig. 1



Fig. 2

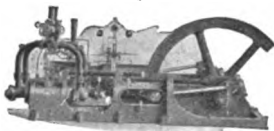


Fig. 3



Fig. 4

Fig. 1 illustrates Vilter Tandem Compound Engine with poppet high pressure and Corliss low pressure cylinder direct connected to Rolling Mill compressor frame. The most economical combination known using high pressure superheated steam. A leading feature is the valve gear operated through wrist plates driven from eccentrics.

Fig. 2. A duplex unit with horizontal double acting ammonia compressors, direct connected to Cross Compound Corliss Engine. Compressors equipped with multiple valve heads giving maximum area. The duplex type is built in sizes from 125 to 750 tons daily refrigerating capacity.

Fig. 3. The Rolling Mill frame machine is built along very heavy lines for all conditions of service. It is used with only slight modifications in all sizes of compressors. Its very appearance gives assurance and proof of its strength and reliability. All parts of the base rest upon the foundation, thus giving a uniform distribution of the load and insuring maximum stability and rigidity.

Fig. 4. The Rolling Mill type Corliss Engine is of massive construction throughout, the pillow block and guide being made in one casting, securing great strength and rigidity. It is adapted to any class of service from a steady belt load to direct connected electrical units.

Fig. 5. The belt driven machines are furnished in either single or duplex units. These units may be driven by electric motor, gas or oil engines,

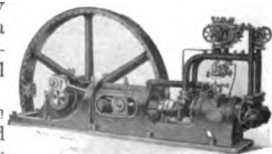


Fig. 5

etc. Single units built in sizes from 6 to 175 tons daily refrigerating capacity, duplex units in sizes from 12 to 750 tons daily refrigerating capacity.

### SMALL CAPACITY VERTICAL AMMONIA COMPRESSORS

Fig. 6. A small, single-acting compressor, especially designed for users of comparatively small quantities of refrigeration. The design unites the base, main bearing and crank case in a single massive casting, cylindrical sections being used throughout giving simplicity, symmetry and strength. Single units either belt or steam driven, made in sizes from 1 to 12½ tons daily refrigerating capacity. We can also furnish small capacity compressors of twin cylinder design.



Fig. 6

### LITERATURE

Bulletins, catalogues and full data regarding our product mailed on request.





## NORDBERG MFG. CO.

MILWAUKEE, WIS.

Engineers and Designers of High Efficiency Poppet Valve Engines, Poppet Uniflow Engines, Corliss Engines, High Compression Oil Engines, Nordberg-Carels Diesel Type Engines, Air Compressors, Blowing Engines, Steam, Air and Electric Hoists

### POPPET VALVE ENGINES

Nordberg Poppet Valve Engine operate with steam consumptions as low as 16 lb. per hp. hour non-condensing. These engines are of high speed design with new type of valve gear and are built especially for use with high pressure superheated steam.

### POPPET VALVE UNIFLOW ENGINES

These engines have Poppet steam valves but exhaust through ports in the cylinder wall uncovered by the piston. A Uniflow Engine operating on a widely fluctuating load gives a lower average steam consumption than a compound condensing engine.

### CORLISS ENGINES

Nordberg Corliss Engines are built in all sizes with both the standard and Long Range valve gear.

### HIGH COMPRESSION TWO CYCLE OIL ENGINES

This is the simplest oil engine on the market today. There are no valve gears or valves subject to the working pressure and heat. The only valve is a low pressure piston valve for scavenging air. These engines are built in three sizes only, 50, 100 and 200 hp.

### NORDBERG-CARELS DIESEL TYPE ENGINES

In large sizes up to and including 1,500 hp., the Nordberg Company builds Diesel Engines under patents of Carels Frères, who have built more large Diesel Engines than any other company in the world.

### ELECTRIC HOISTS

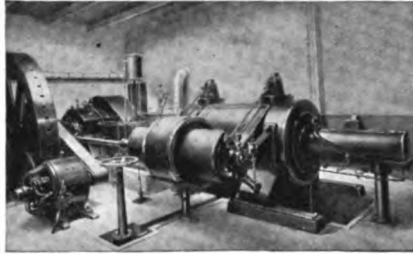
Nordberg Electric Hoists are built in sizes having drums from four feet in diameter up to the largest now operating in this country.

### STEAM AND AIR HOISTS

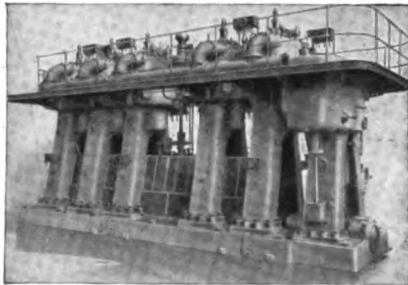
Nordberg Steam Hoists are well known to all mining men. Practically all of the large hoists for high speeds and great depths have been built by the Nordberg Co.

All of the successful compound condensing steam hoists and all the Air Hoists are of Nordberg make.

*Bulletins sent upon request.*



Nordberg Poppet Valve Engine as recommended for non-condensing installations. The valve gear opens and closes the valves positively without the use of springs or dash pot and all valves seat in removable cages, which are fitted in the heads



Nordberg-Carels Diesel type engine of 1250 brake hp. This is a two-cycle engine of the design most widely used in large sizes throughout Europe and Asia



Nordberg First Motion electric driven hoist for the Elm Orlu Mining Co., Butte, Mont.; load 32,000 lbs.; depth 3,500 ft.; hoisting speed 2,500 ft. per minute

## **ROBT. WETHERILL & CO., INC.**

**DEPARTMENT OF SUN SHIPBUILDING CO.**

**Established 1872**

**CHESTER, PA.**

**Manufacturers—Power Plants, Elevators, Corliss Engines, Heavy Machinery, Castings, Heaters, Plate Metal Work, Marine Engines, Boilers, Shafting, Etc.**

### **WETHERILL CORLISS ENGINES**

These include Heavy Duty and Girder Type Corliss Engines, Single Cylinder and Compound, adapted to the exacting requirements of alternating and direct-current work for any service—Rolling Mills, Pumping Engines, Air Compressors or any installation where reliable power is required.



18

Our Gravity Type Valve Gear (patented) is designed for high rotative speeds, applicable to office building installation; smooth and noiseless in operation. All valve gear details with accurate wedge adjustment; no driven keys used in the construction.

Corliss Engines built any size and capacity, from 50 H. P. to 5000 H. P.

### **ELECTRIC AND PLUNGER ELEVATORS**

**For Passenger and Freight Service**

Our Elevator Department is equipped with the most modern tools for the production of both types of elevators, for high-speed passenger and freight service.

Our recent installation of Plunger Elevators in the Hotel McAlpin, 33rd Street and Broadway, New York City, may be said to represent the latest development and patents in Plunger Elevator construction. We also supplied the Well Rooms with Improved Automatic Valves, Oil Buffers, and our Corliss Three-Cylinder High-Duty Crank and Fly-Wheel Type Pumping Engine for Elevator Service. Plungers and cylinders are of specially selected heavy steel tubing; plungers finished to micrometer gauges, insuring minimum friction losses and long life.

Where local conditions are such that the Electric Type is to be installed, our Improved Electric Traction Machine is used, designed for high-speed service, of the Worm-Gear Traction Type, with modern method of roping. Thirty-three of this type of Elevator were installed by us in the new Municipal Building, Center and Chambers Streets, New York City.

### **STEEL PLATE DEPARTMENT**

Our Steel Plate Department is equipped with Traveling Cranes and Hydraulic Riveters. Punches and tools for the manufacture of heavy steel plate construction—Boilers, Tank Work and Stacks; and Kilns, Coolers, Dryers, Storage Bins, etc., for Cement Mills.

**Heavy Machinery estimated on and constructed from engineers' designs.**

# KERR TURBINE COMPANY

WELLSVILLE, N. Y.

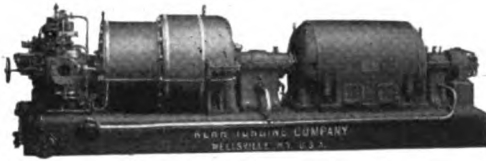
Offices in All Large Cities

**Manufacturers of Kerr Economy Steam Turbines for Driving Generators, Pumps, Blowers, Shafting, Etc., and Kerr Economy Herringbone Reduction Gears**

**KERR ECONOMY STEAM TURBINES** are of the multi-pressure stage type with one revolving element per stage. A sufficient number of stages are used to insure good economy with low steam velocities and consequent absence of bucket erosion, resulting in exceptionally low interest and depreciation charges.

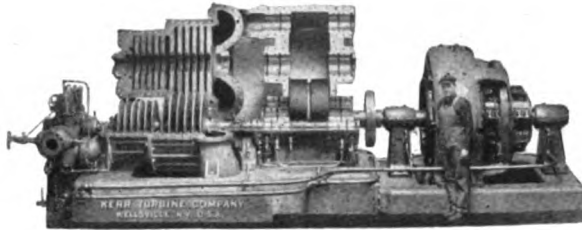
### Correct Design for Each Condition

Our flexibility of design and construction permits of economical operation on any combination of initial and exhaust pressures, without special design or excessive cost.



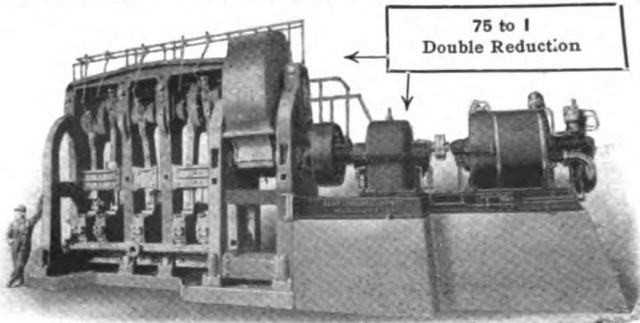
Standard direct connected Kerr Economy Turbo-alternator. Built in sizes from 75 to 1000 kw.

**750 kw. Geared Kerr Economy Turbo-generator** with casing raised, showing ease of access. Note that the turbine disks and gears are completely exposed down to the shaft.



**KERR ECONOMY BLEEDER TURBINES** are designed to permit of steam extraction from intermediate stages of the turbine at the proper pressures (automatically maintained) for heating and similar purposes, the balance of the steam passing through and doing work in the remaining stages of the turbine. Every ounce of energy is thus taken from the steam before it goes to the condenser.

**KERR ECONOMY HERRINGBONE REDUCTION GEARS** are cut on the most accurate gear hobbing machines obtainable. A wide range of sizes insure the same flexibility that is the salient feature of Kerr Economy Turbines.



75 to 1  
Double Reduction



TRADE MARK

Write for illustrated bulletins.

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\*Southwest General Electric Company.

†General Electric Company of Michigan.

For CANADIAN BUSINESS refer to Canadian General Electric Company, Ltd., Toronto, Ont.

GENERAL FOREIGN SALES OFFICES, Schenectady, N. Y.; 30 Church St., New York City; 83 Cannon St., London, E. C., England.

**Manufacturers of Complete Electrical Power Plant Equipments and Supplies**



The General Electric Company's monogram trade mark is known all over the world. It is the Guarantee of Excellence on Goods Electrical.

## GENERATING APPARATUS

The Curtis turbine is built in all sizes from the smallest exciter set to the 50,000 KV-A size—the largest in the world. They are suitable for condensing or non-condensing service, and are also furnished in low pressure or exhaust steam, and mixed pressure types. The latter can be used with high or low pressure steam or both. Steam extraction turbines are furnished where exhaust steam is needed for heating or manufacturing purposes. Engine driven generators are regularly furnished in capacities ranging from 5 to 1,000 Kw. direct current and from 100 to 5,000 Kw. alternating current. Water wheel driven generators have been built in all desired sizes and voltages up to 10,000 horsepower at 11,000 volts. The General Electric Company has had more experience than any other company in building high voltage generators. These machines do not deteriorate in their windings and are very conservative in temperature ratings.

## SYNCHRONOUS CONVERTERS—MOTOR GENERATORS

Synchronous converters and motor-generator sets provide an economical method for changing electric power of any standard frequency and voltage from alternating to direct current or vice versa.

## SWITCHBOARDS

For all ordinary requirements the necessary panels can be selected from the G-E catalogs of Standard Unit Panels, and combined into a switchboard that will satisfy every requirement of the installation. The advantages of this method are convenience in ordering, prompt shipment and low price, the latter two resulting from the elimination of engineering and drafting on the individual order. The standard unit system is explained in Bulletin 47001.

For high voltage plants and other cases where unusual requirements must be met, special switchboards are designed to meet any conditions of control.

Switchboard specialists are located at many of the principal offices of the company and will furnish data which will enable the engineer to specify a complete switchboard especially adapted to his particular requirements and with all parts built, assembled and tested as a unit by one company.

## INSTRUMENTS—METERS

Switchboard and testing instruments and all kinds of electric meters cover fully the requirements for measurement of power.

## REGULATORS

Automatic regulators are furnished for keeping the voltages constant on alternating or direct current power and lighting circuits.

## GENERAL ELECTRIC COMPANY

### TRANSFORMERS

Type H distributing transformers have unusually high factors of safety to ensure reliable service under the severest operating conditions, such as sleet, snow, lightning, overload, etc. The General Electric Company has standardized and carries in stock complete lines of these transformers in capacities 200 KV-A and less for potentials 6,600, 10,000, 13,200 and 33,000 volts.

G-E power transformers are built in all sizes and are operating very successfully on potentials as high as 150,000 volts. These transformers have superior features which ensure unusual ruggedness when operating under modern transmission conditions of high power and high potential where the strains due to abnormal current, voltage and frequency are unusually severe.

### LIGHTNING-ARRESTERS

For alternating current circuits the aluminum arrester is recommended as giving the best protection attainable for station equipment.

For distributing transformers, the graded shunt resistance multigap or the compression chamber multigap arrester may be used. The former is sensitive over a wide range of lightning frequencies and should be installed for protection of the larger transformers. The compression chamber arrester, lower priced and slightly less efficient, should be used to protect all the smaller transformers.

For direct current circuits the magnetic blow-out arrester is available. Where a very high degree of protection is desired, aluminum arresters should be used.

### WIRE AND CABLE

The General Electric Company manufactures wires and cables insulated with paper, varnished cambric, rubber or composite (graded) insulation. To meet different conditions of service these cables are furnished with protective coverings of cotton, asbestos, lead, band steel or wire armor.

### LAMPS, INCANDESCENT AND ARC

Standard lighting units ranging from a 10 watt EDISON MAZDA lamp to the flame arc lamp for lighting large areas are carried in stock. Lighting specialists and illuminating engineers of the General Electric Company will assist in laying out any lighting system.

### WIRING DEVICES

G-E reliable wiring devices include sockets, receptacles, switches, cut-outs, fuses, attaching plugs, rosettes, cleats, insulators, and numerous wiring specialties. All these types are N. E. C. standard.

### MOTORS AND CONTROLLERS

ALTERNATING CURRENT MOTORS for 110, 220, 440 and 2,200 volts at all standard frequencies; constant or variable speed; for continuous or intermittent duty; hand or automatic control.

DIRECT CURRENT MOTORS for 115, 230 and 550 volts; slow or moderate speed; belt, chain, gear or direct drive. Constant, variable or adjustable speed for continuous or intermittent duty. Suitable control for any service.

All motors are insulated for long life. Specially insulated motors for service in acid or alkaline vapors, excessive alkaline dust, or temperatures as high as 150° C. can be furnished.

The General Electric Company has a motor for every power application, large or small, a controller for every motor, and a specialist who can assist in the combined application to obtain the most satisfactory and economical results.

### FLOW METERS

The General Electric Company has developed a practical device for measuring the flow of steam in pipes. The G-E steam flow meter can be installed in any sized pipe at a small expense, and will give reliable readings of the flow. They are specially useful in the boiler plant and turbine room for measuring the output of the individual boiler and the input of the turbines. G-E flow meters are also furnished for measuring the flow of water, air and natural gas.

### BULLETINS—FURTHER INFORMATION

Only a few of the products of the General Electric Company are described above. Bulletins, giving information, illustrations and full data on complete electrical apparatus for the power house will be mailed on application from our nearest office.



## BUSCH-SULZER BROS.-DIESEL ENGINE COMPANY

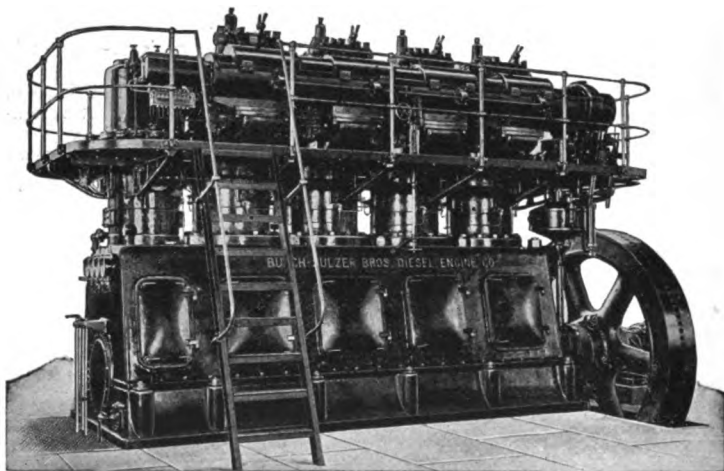
ST. LOUIS, MO.

Builders of Diesel Engines

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*This Company is the original and was, from 1898 to 1911, the only company manufacturing DIESEL Engines in America. It owns all U. S. patents granted to Dr. Rudolph Diesel, and is closely associated with the old firm of Sulzer Bros., of Winterthur, Switzerland, with which it is in intimate co-operation.*

---



**STANDING:** Original manufacturers of the Diesel Engine in America. We can refer you to satisfied users of nearly 100,000 H. P. of Diesel Engines built by us during the past fifteen years, in plants of from 120 H. P. to 3600 H. P. installed in Central Stations, Pumping Plants, Flour Mills, Ice Plants and Industrial Plants.

**MANUFACTURING FACILITIES:** New manufacturing plant at St. Louis specially designed and equipped for building of high grade Diesel Engines—devoted solely to building Diesels.

**QUALITY:** Long years of experience in design, the selection of raw materials, the requisite refinement in manufacture afforded by adequate shop facilities, insure reliability, low upkeep and long life.

**PRICES:** Groups of engines of standard sizes are brought through factory on shop order—thus reducing manufacturing costs as low as is commensurate with quality of product.

**TYPE AND SIZES:** Type B—vertical—four-cylinder—single acting—4-stroke cycle. Sizes—120 H. P., 165 H. P., 250 H. P., 365 H. P., 520 H. P. Medium speeds—suitable for belt, rope, or direct coupled drive.

Type B supersedes Type A, is equipped with compressor built integral, shaft maintained in factory alignment by rigid bearings, forced feed lubrication, etc., etc. Type M Marine Diesel Engines—particulars on request.

**PUBLICATIONS:** Diesel Engine performance bulletins and operating records in Central Stations, Water Works, Ice Plants, Flour Mills, Industrial Plants, gladly mailed on request.

## FULTON IRON WORKS CO.

Established 1852

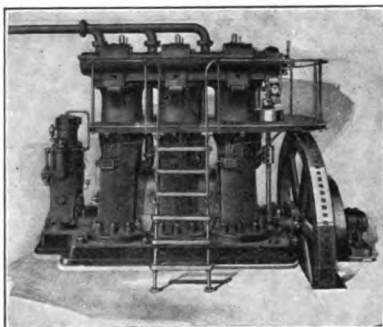
MAIN OFFICE AND WORKS, ST. LOUIS, MO.

**Builders of Fulton-Tosi Oil Engines, Diesel System, Corliss and Medium Speed Steam Engines**

### FULTON-TOSI OIL ENGINES (DIESEL TYPE)

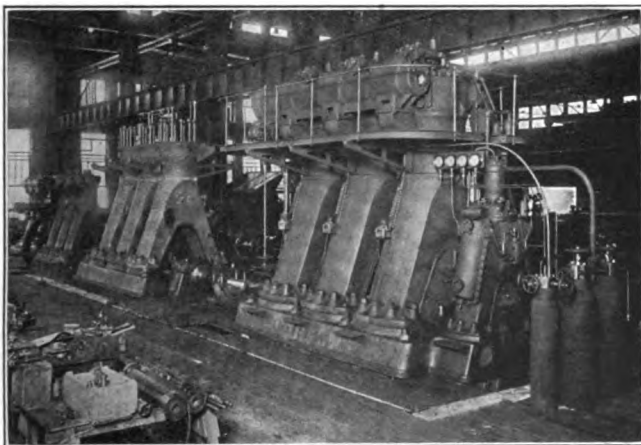
The Fulton-Tosi Four-Cycle Oil Engine is built in the vertical form, "A" frame, and in two, three, four and six cylinder arrangement. The engine is designed to operate on the cheapest petroleum, crude or fuel oils, or tar oils, with greatest reliability and economy, and as ignition is insured by the heat of compression, no hot bulb, electric spark, or other exterior means of ignition is required.

*The engine may be started up from cold within one minute, without any troublesome or time-consuming preliminaries. The operation of the engine is comparatively quiet, very clean and perfectly safe, permitting of its installation almost anywhere. Tanks for the storage of fuel oil may be buried under buildings, driveways, or in any other convenient location, without interfering with the use of the space above for other purposes.*



The Fulton-Tosi Four-Cycle Oil Engine is built in sizes ranging from 100 B.H.P. in two cylinders to 1000 B.H.P. in six cylinders. These engines are suitable for any power purpose, including electric light and power plants, water works, flour mills, textile mills, irrigation plants, etc. Where the requirements as to regularity of speed are extremely exacting, we recommend the selection of an engine with at least three cylinders.

23



Diesel Engine Erecting Floor

*Bulletin  
800 giving  
details  
will be  
gladly  
forwarded  
upon  
request.*

**FULTON-CORLISS STEAM ENGINES** are built in horizontal and vertical types; simple, tandem, or cross compound up to 3000 H.P. This is probably the heaviest line of releasing gear Corliss engines built in America.

For higher speed work we build a line of non-releasing gear Corliss valve engines, the steam economy of which corresponds closely to that of the low speed releasing gear line.

*"Over sixty years of successful manufacturing."*

## **McINTOSH & SEYMOUR CORPORATION**

**AUBURN, N. Y., U. S. A.**

### **BRANCH OFFICES**

**NEW YORK CITY, 3006 Singer Bldg.**

**EL PASO, 608 Mills Bldg.**

**DALLAS, 309 Interurban Bldg.**

**MANILA, P. I., Pacific Commercial Co.**

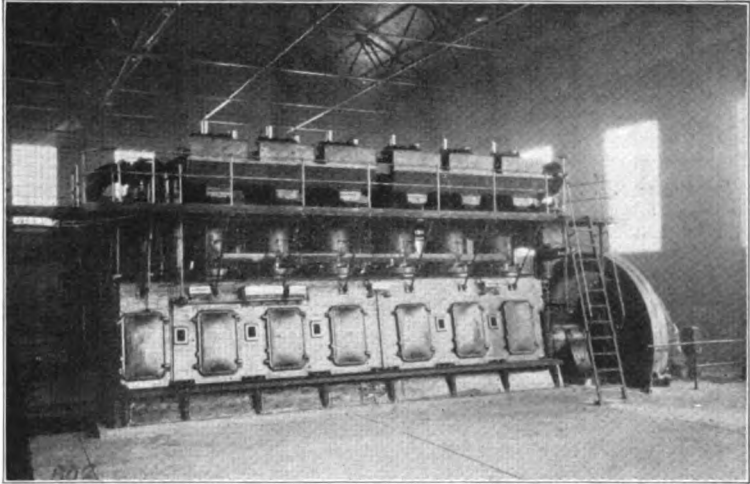
**WASHINGTON, Southern Bldg.**

**KANSAS CITY, 700 Interstate Bldg.**

**ST. LOUIS, 2086 Railway Exchange Bldg.**

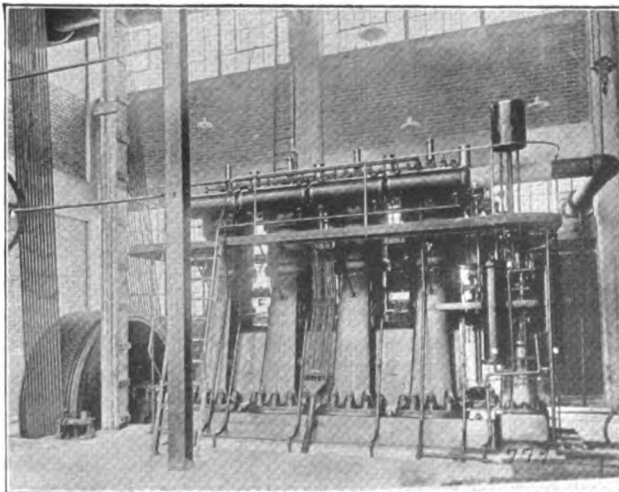
**SAN FRANCISCO, 303 Sheldon Bldg.**

**Builders of Stationary and Marine Diesel Type Oil Engines**



The cut just above shows One of Four 1000 B. H. P., 6 cylinder, 4 cycle, size B-44 Diesel Type Oil Engines, operating continuously at full load in the Power Plant of the Lehigh Portland Cement Company, at Iola, Kansas.

While the view below shows a 500 B. H. P., 4 cylinder, 4 cycle, size A-38 Diesel Type Oil Engine, operating the Flour Mill, by means of rope drive, in the Plant of the El Reno Mill & Elevator Company at El Reno, Oklahoma.





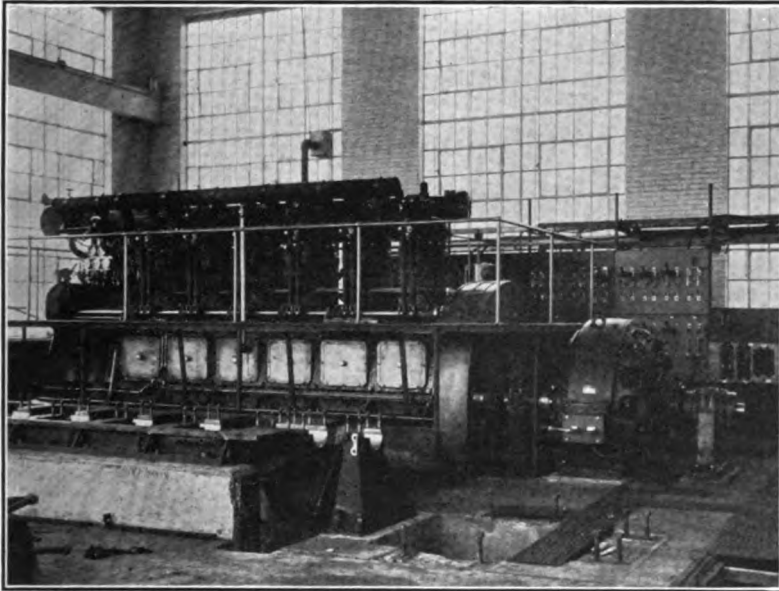
# NEW LONDON SHIP & ENGINE CO.

GROTON, CONN., U. S. A.

**Manufacturers of Stationary and Marine Diesel Engines**

## NELSECO DIESEL ENGINES

Burn the same cheap fuel oil, or crude, as is commonly used under steam boilers. Consumption, 6 gallons per 100 H. P. per hour.



**360 H. P. Four-Cycle Nelseco Diesel Crude Oil Stationary Engine**

Nelseco Diesel engines are always ready for instant starting.

They are simple in design, construction, and operation—and the upkeep very low.

**Over 50,000 H. P. in Service, and over 50,000 H. P. Building**

*Gold Medal of Honor—Panama Pacific Exposition  
Adopted by United States and Foreign Governments*

**SIZES: 120, 180, 240, 360, 480, 600, 800, 1200 to 2500 H. P.  
Stationary and Marine Types.**

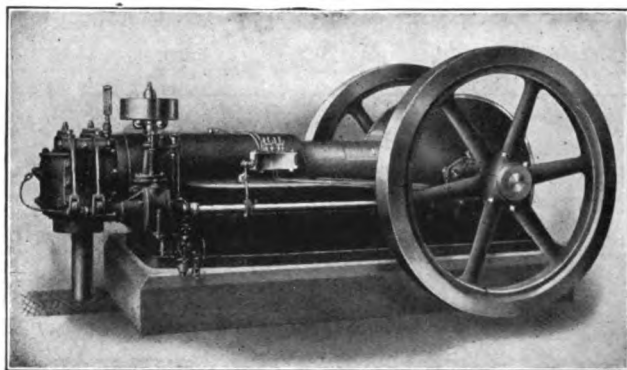
*Write us your requirements.*



## DE LA VERGNE MACHINE COMPANY

1123 EAST 138TH ST., NEW YORK CITY

"De La Vergne" Crude Oil Engines, Refrigerating Machinery, Ice Machines

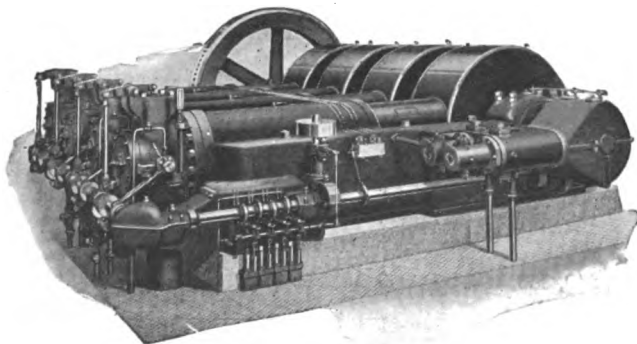


Single Cylinder Type "DH" 60 H. P. De La Vergne Oil Engine

26

**"DE LA VERGNE" OIL ENGINES** are guaranteed to operate on any commercial fuel or crude oil in the United States or Mexico. The type "FH," built in sizes from 100 to 600 H. P., has a fuel consumption of less than .5 pound of oil per brake horsepower per hour. The type "DH," built in sizes from 25 to 200 H. P., has a fuel consumption of .55 pound of oil per brake horsepower per hour. Both types are provided with separate uncooled vaporizing chamber, in which the oil is gasified and ignited. No fuel enters the cylinder. Carbonization troubles are entirely eliminated.

These engines have operated with perfect satisfaction on gas-house tar, and even coarse road oil has been burned for long periods. Pressures are moderate. In the "FH" type the average cylinder pressure is about 300 pounds. In the "DH" type the average cylinder pressure is about 150 pounds. All engines are horizontal, of very heavy construction and designed particularly for 24 hours' continuous service in stationary power plants.



600 H. P. 4 Cylinder Type "FH" De La Vergne Oil Engine

Full details are given in bulletins, which will be gladly sent upon application.



# **WORTHINGTON PUMP AND MACHINERY CORPORATION**

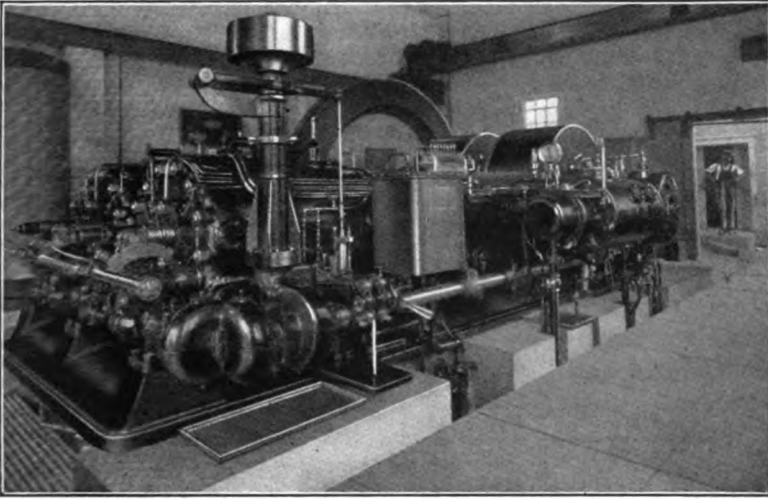
**115 BROADWAY, NEW YORK**

**SNOW-HOLLY WORKS: BUFFALO, N. Y.**

**Branch Offices in All Principal Cities**

**Snow Oil Engines  
Snow Gas Engines**

**Snow Oil Line Pumps  
Snow Gas Compressors**



27

## **THE SNOW OIL ENGINE—A SELF-CONTAINED POWER PLANT**

The Snow oil engine is of the four-cycle, single, twin or three cylinder type and operates on the high compression cycle. On account of this latter feature there is no sudden rise in pressure with the result that the wear due to shock is eliminated. The temperature of the compressed air is sufficient to ignite the fuel so that a hot bulb or ignition apparatus of any kind is not required.

We have developed a spray nozzle or atomizer which completely converts into fine spray the heaviest grades of asphalt base crude oils and residuums from the Mexico and California fields as well as the lighter fuel oils and distillates from the eastern and mid-continent fields.

Snow oil engines are simple, reliable, and can be depended upon for continuous service. In their design particular attention is given to accessibility and the reduction of operating attention to a minimum. They are rated conservatively and are subjected to a rigid brake test on our erecting floor before shipment. They are adapted to all power purposes, including belting to generators or line shafts, direct connection to generators for parallel operation, and direct connection to oil line pumps, air compressors or ammonia compressors.

Our standard fuel guarantees, based on crude oil, distillate, or fuel oil of 18,500 B. T. U.'s per pound containing not over 1% of water, are as follows:

.48 lb. per B. H. P. hour at full load.

.50 lb. per B. H. P. hour at  $\frac{3}{4}$  load.

.57 lb. per B. H. P. hour at  $\frac{1}{2}$  load.

**ASK FOR FURTHER DETAIL INFORMATION.**

**S 221.8**

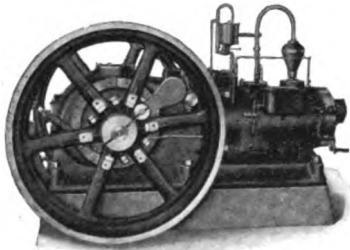
## AUGUST MIETZ MACHINE WORKS

123 Mott St., NEW YORK

**Manufacturers of Oil Engines, Marine and Stationary, Direct Connected or Belted to Generators; Air Compressors; Pumps; Hoists**

Our Engines, both Stationary and Marine, received the **HIGHEST AWARD** for injection type oil engines at the Panama-Pacific International Exposition.

**STATIONARY AND MARINE, 2 TO 600 H. P.  
DIRECT REVERSIBLE MARINE ENGINES 75 TO 600 H. P.**

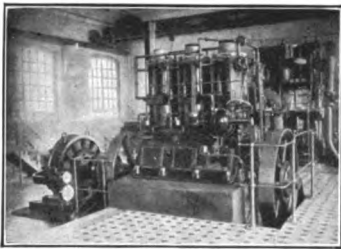


**50 and 75 H. P. Horizontal Engine**

**Over 250,000 H. P. in Operation**

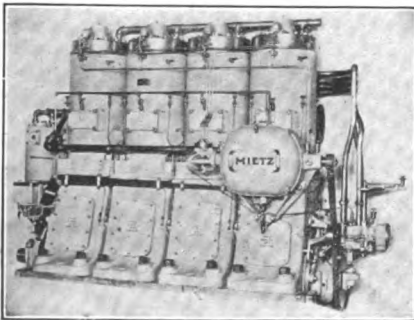
These engines are operated at moderate compression pressures and medium speeds, consuming approximately one gallon of crude oil or other fuel per ten horsepower hours, at a cost of three cents. The smaller sizes generally run with kerosene.

They are two-cycle, heavy-duty engines, extremely simple, and, equipped with our steam cooling system, the reliability and durability are equal to the modern steam engine. The steam generated in the water jacket of the cylinder enters the combustion space and is compressed with the charge. This gives increased economy and mean effective pressure, better scavenging and lubrication, and necessitates an extremely small quantity of cooling water.



**150 H. P. Generator Set**

Our Engines are used for all power purposes, pumping and electric light plants either direct or belted to generators, operating in parallel.



**200 H. P. Marine Engine**

**The Direct Reversible Marine Engines** are rigidly connected to the propeller shaft, without fly wheel and fitted with the S & W Air Distributor. They are controlled by a lever to stop or start the engine in either direction by compressed air through most reliable and positive mechanism.

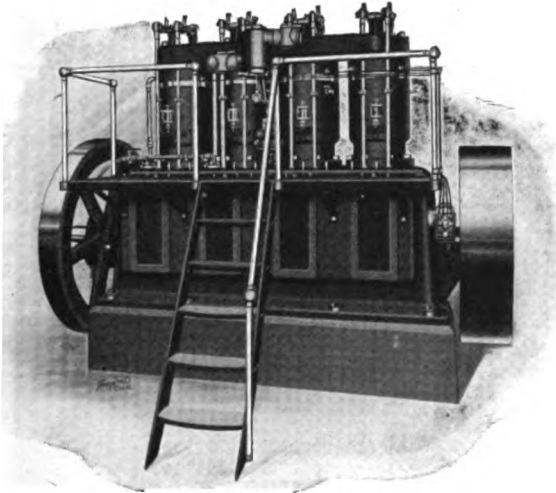
# HOPE ENGINEERING & SUPPLY CO.

MT. VERNON, O.

TULSA, OKLA.

PITTSBURGH, PA.

Consulting and Contracting Engineers Specializing in Natural Gas and Petroleum,  
Gasoline Absorbers, Heat Exchangers and Gas Engines



## REEVES VERTICAL GAS ENGINE

Made for Any Fuel Gas

Natural—Artificial—Producer

### DATA

Horse Power (Natural Gas)	Cylinders			R.P.M.	Shipping Weight	Floor Space	Price F. O. B. Mt. Vernon, Ohio
	No.	Diam.	Stroke				
18	1	9½	11½	300	5800	48 x 54	\$1529.00
40	2	9½	11	300	9000	72 x 58	2365.00
60	3	9½	11	300	12500	88 x 58	2970.00
80	4	9½	11	300	17000	104 x 58	3905.00
100	3	11½	13	275	20000	106 x 76	4565.00
115	3	12¼	13	275	22000	106 x 76	4950.00
135	4	11½	13	275	26000	126 x 76	5610.00
150	4	12¼	13	275	28000	126 x 76	6160.00
170	4	12½	14	275	36000	144 x 80	7700.00
200	4	14	14	275	40000	144 x 80	9020.00

*Wire for discount.*

## NATIONAL METER COMPANY

Established 1870

84-86 CHAMBERS ST.

NEW YORK CITY

### BRANCH OFFICES:

CHICAGO, 1227 Wabash Ave. BOSTON, 159 Franklin St. CINCINNATI, 224 East 4th St.

PITTSBURGH, 4 Smithfield St. ATLANTA, 3d Nat. Bank Bldg. LOS ANGELES, 411 S. Main St.

SAN FRANCISCO, 141 New Montgomery St. WINNIPEG, MANITOBA, 229 Spence St.

LONDON, Caxton House

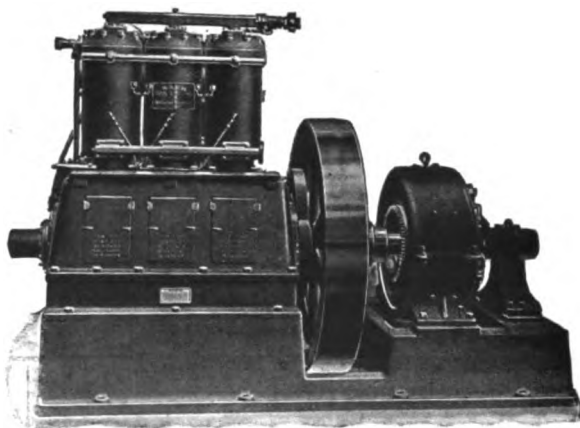
**Manufacturers of Water Meters and Gas Engines**

### NASH GAS ENGINES

**To Operate on Illuminating Gas, Gasoline or Producer Gas  
Simple, Silent, and Efficient**

The engine throughout is the embodiment of the latest and best ideas of gas engine design and construction.

Is of very liberal proportions and high grade in every detail. The NASH has many exclusive and valuable features.



All sizes of NASH engines are of the four-cycle type and are fitted with throttling or hit and miss governors as may be selected or best suited to the conditions.

The National Meter Company is the originator of the throttling governor for gas engines and the NASH was the first gas engine to be equipped with it.

In regulation, the NASH Gas Engine is on a parity with that of the best steam engines.

Due to its high economy, closeness of regulation and quietness of operation it meets a great range of power requirements.

Manufactured in all sizes from 25 to 300 H. P.



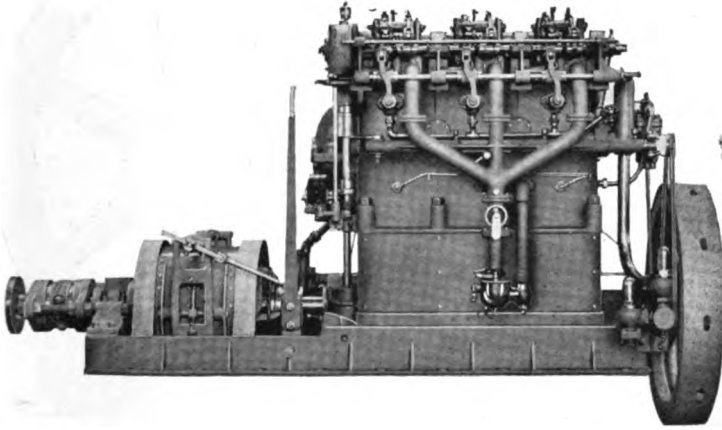
# STANDARD GAS ENGINE CO.

FACTORY AND MAIN OFFICE  
EAST OAKLAND, CALIF.

Builders of KEROSENE Engines

## THE "FRISCO STANDARD" HEAVY DUTY INTERNAL COMBUSTION ENGINE

*The World's Standard Vertical Heavy Duty Motor Now Furnished  
to Operate on Gasoline, Benzine, Distillate, Kerosene, Alcohol,  
Sunoil, Tops, Gas Oil, and Commercial or Natural Gas*



**Three-Cylinder Marine Built in Sizes 25 to 110 Horse Power**

Four-cycle, valve-in-head construction.

Weight to withstand continuous heavy service.

Fuel consumption one-tenth gallon per horse power per hour.

Iron castings best quality gray iron, made in our own foundry.

Crankshafts forged from solid billet best hammered steel.

Each bloom tested by Lloyd's agent according to Lloyd's register for marine shafting.

Throttling governor gives governing control of 4% between full load and no load.

Marine engines of more than 40 H. P. and stationary engines of more than 100 H. P. are equipped with two circulating water pumps.

Marine engines, 4 to 275 horse power.

Hoisting engines, with single and double drum hoists in any power.

Marine winches for cargo hoisting and anchor hoisting.

Pumping plants in all sizes and types.

Direct connected electric outfits, 1.8 to 180 kilowatts.

Let us show you how you can deliver current at your switchboard for 1.5 cents per kilowatt hour, with absolute reliability.

*A post-card will bring our catalogues and prices.*

## WESTERN MACHINERY COMPANY

(Successor to Western Gas Engine Corp. and Schweitzer Machine Co.)

900 NORTH MAIN ST., LOS ANGELES, CALIF.

Manufacturers and Distributors of Mining, Irrigation and Power Machinery

**BRANCHES:**

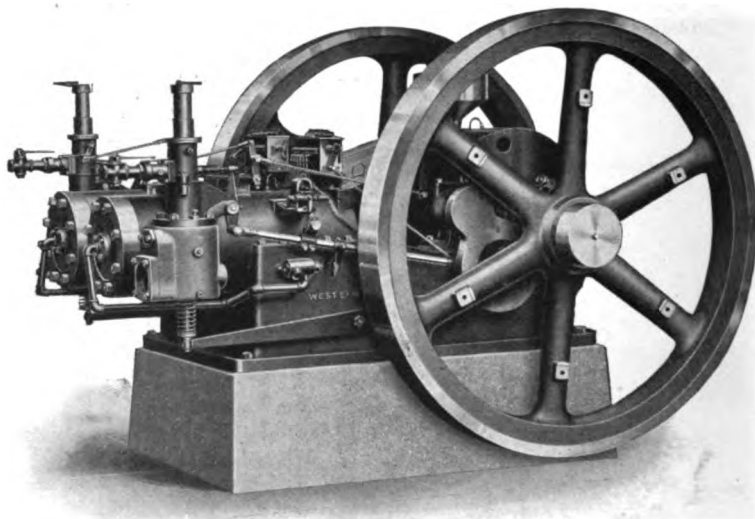
423 Rialto Building  
SAN FRANCISCO, CALIF.

Odd Fellows Building  
TUCSON, ARIZONA

Agencies in principal cities

320 Brower Building  
BAKERSFIELD, CALIF.

326 E. Washington, St.  
PHOENIX, ARIZONA



### "WESTERN" TYPE "G" ENGINE (Gas and Heavy Distillate Engine)

Using vertical valves, "WESTERN" patent vaporizer, fuel pump which needs no packing, high tension ignition, force feed lubrication. We have special designs in these engines for the following duties:

Mining Hoists 12 to 100 H. P.

Stationary Engines, single cylinder, 12 to 80 H. P.

"Duplex" Twin-Cylinder Engines 80 to 120 H. P.

Four-Cylinder "Twin-Duplex" Engines 200 and 240 H. P.

Oil Field Pumping Engines 20 to 40 H. P. used in conjunction with "WESTERN" patent reverse gear which excels all other similar equipment in the oil fields.

### "WESTERN" FOUR-CYCLE HEAVY OIL ENGINE (Suter design)

These engines are of the four-cycle type made with Patented Fuel Injection Valve and are designed to burn 24° Baumé gravity oil. This is the only type of true Semi-Diesel engine built. Using Diesel compression. Using Diesel fuel. Giving Diesel economy and still carrying standard internal combustion engine simplicity. No air compressor or high pressure injection valves. No spray nozzles to give trouble. No expense or cost has been spared to make this the highest type of internal combustion construction and it is designed and built for the heaviest kind of service and constant duty. Made in 25 and 60 H. P. cylinder sizes, one- to six-cylinder units, vertical type.

*Bulletins on application.*



# HALL-SCOTT MOTOR CAR CO., INC.

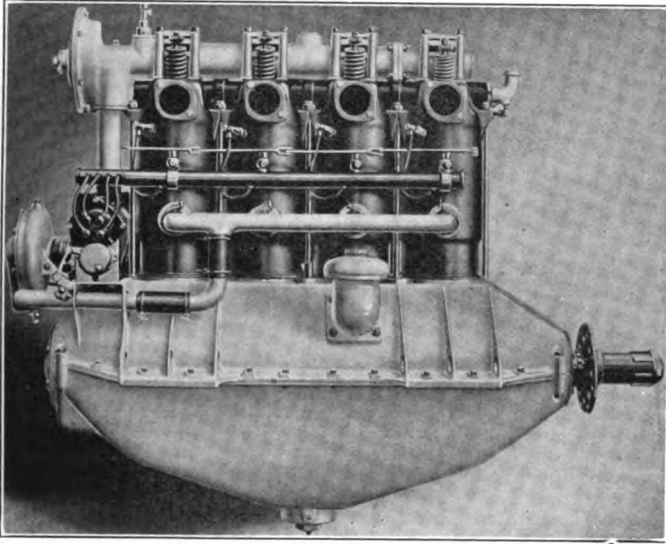
GENERAL OFFICES

CROCKER BLDG., SAN FRANCISCO, CALIF.

EASTERN REPRESENTATIVE: F. P. Whitaker, 165 Broadway, NEW YORK CITY

Designing Engineers and Manufacturers of Airplane Engines

## HALL-SCOTT AIRPLANE ENGINES



The Hall-Scott "Big Four" Airplane Engine

The Hall-Scott, Four and Six cylinder, vertical, water cooled, Airplane Engines are the result of nine years of careful engineering and development, in the largest and most up-to-date Airplane Engine Factory in the United States.

They are offered in two models:

Type A7a, Four cylinder vertical, conservatively rated at 100 H. P. at 1,350 R. P. M. Weight complete, 410 lbs.

This engine is particularly adapted for use in connection with primary and advanced training machines.

Type A5a, Six cylinder vertical, conservatively rated at 150 H. P. at 1,350 R. P. M. Weight complete, 575 lbs.

This engine is particularly adapted for use in connection with heavier type land and water planes.

*Hall-Scott airplane engines have most successfully passed all United States and foreign government test requirements and are being generally used by leading United States airplane builders.*

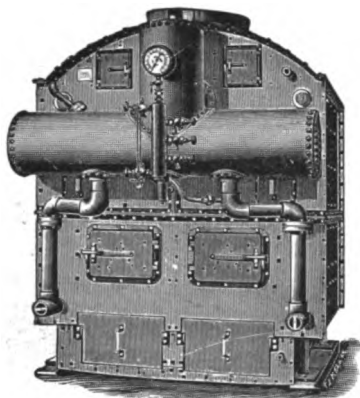
*Four world records, accepted by the Aero Club of America, the Aero Club of Great Britain and the Aero Club of France, are held by American built seaplanes, Hall-Scott equipped.*

# ALMY WATER TUBE BOILER CO.

PROVIDENCE, R. I.

Sectional Water Tube Boilers for Every Marine Purpose

## ALMY PATENT SECTIONAL WATER TUBE BOILERS



Exterior—Class B, C, D

34

The Almy Boiler is in every respect a Pipe Boiler, being constructed of Extra Strong Iron Pipe and Malleable Iron Fittings. As the threads are standard size, repairs may be made conveniently in almost any part of the world. Due to design, expansion and contraction is entirely taken care of and sudden change of temperature has no bad effect on the heating surface. 75 lbs. to 100 lbs. of steam may be raised from cold water within seven minutes with perfect safety.



Interior  
Class A, B, C

We build six classes or types of boilers—A, B, C, D, E and Z. Type is determined according to the desired duty. Sizes run from 2.7 to 56 sq. ft. of grate surface and 87 to 2,000 sq. ft. of heating surface.

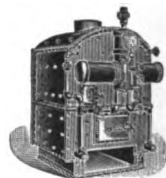
An evaporation of 11.92 lbs. of water from and at 212° per pound of combustible has been shown on a 45 H. P. boiler—rate of combustion 14 lbs. per square foot of grate surface per hour. The same boiler under forced draft evaporated 7.89 lbs. of water per pound of coal—gage pressure 153 lbs., feed temperature 56°, rate of combustion 35.98 lbs. of coal per square foot of grate surface per hour.

The large amount of fire-box heating surface receiving direct heat is an important feature. In our Class D and E boilers, there is 90% more of such heating surface than in a flat-sided fire box of equal dimensions.

These boilers are very satisfactory with oil burners as quite a number of installations on the Pacific Coast have proved.

Our business is principally marine but we occasionally furnish boilers for stationary use. "Knocked down" boilers may be shipped in 400 lb. packages and under.

*Catalogue containing full description of construction will be sent on application.*



Exterior  
Class A



# BADENHAUSEN CO.

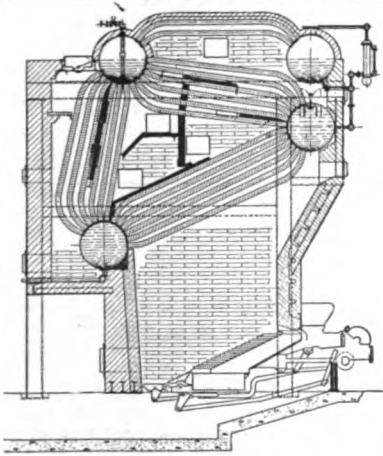
1425 CHESTNUT ST., PHILADELPHIA, PA.

NEW YORK  
111 Broadway

VANCOUVER, B. C.  
Taylor Engineering Co.

SAN FRANCISCO  
438 Rialto Bldg.

Manufacturers of All Steel Water Tube Boilers



## BADENHAUSEN WATER TUBE BOILERS

of the four-drum type, consist of two water drums and two steam drums. The two water drums and the rear steam and water drum are connected by means of tubes, so as to form a perfect cycle of circulation for the water. The steam drum is connected through the water column opening to the lower front drum.

As the areas of the tubes entering the drums and leaving the drums are practically the same, there is **POSITIVE, CONTINUOUS, UNRESTRICTED CIRCULATION**. Here the BADENHAUSEN Boiler excels all other types on the market as the whole life of any water tube boiler must be in the water circulation.

### ADDITIONAL POINTS OF SUPERIORITY

**Safety:** All drums of our boiler are designed and built according to the boiler laws of the State of Massachusetts or the State of Ohio. As may be readily noted there are no contracted areas, headers, water legs, handhole gaskets, handhole openings, etc., and their absence eliminates most factors which lead to boiler explosions. The flexibility of the boiler is such that all variations of temperature are promptly taken care of.

**Ease of Cleaning:** The BADENHAUSEN Boiler is easily cleaned internally by removing four manhole covers and inserting a turbine cleaner into the tube. The outside of the tubes is cleaned by inserting steam lances from the boiler front.

**Simplicity of Erection:** The boiler is supported by heavy steel framing. This framing consists of I-beams in which case the rear steam and water drum rests upon the horizontal I-beams. The water drum is suspended from heavy turned bolts secured to these I-beams, and the mud drum is suspended from the tubes which are connected to the rear steam and front water drums.

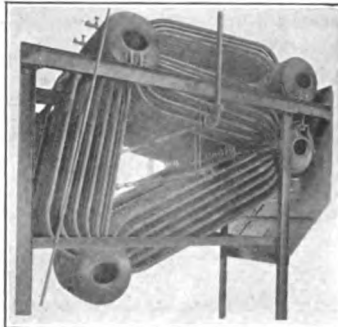
**Facility of Repairs:** Repairs are facilitated by the tubes being spaced alternately wide and narrow, permitting the replacing of any tube without disturbing any other tube. No baffles will be disturbed.

**Ability to Withstand Severe Service:** Owing to the perfect circulation of the BADENHAUSEN Boiler, it will be found that these boilers need less shutting down for internal cleaning than any other boiler on the market.

**Dry Steam:** The steam, while passing through the steam tubes, is dried and superheated. This is a feature which few boilers possess.

**Baffling:** No special baffles needed, standard tile only is used. Baffles easily replaced. Gases must pass all of the tube heating surface.

**Size:** Can be built in all sizes up to 5000 H. P. So far the largest size in operation is 2500 H. P.



Method of Supporting Larger Boilers

## THE BABCOCK & WILCOX CO.

GENERAL OFFICES:

85 LIBERTY STREET, NEW YORK

BOSTON, 35 Federal St.  
PHILADELPHIA, North American Bldg.  
PITTSBURGH, Farmers Deposit Bank Bldg.  
CLEVELAND, New Guardian Bldg.  
CINCINNATI, Traction Bldg.  
ATLANTA, Candler Bldg.  
NEW ORLEANS, 533 Baronne St.  
HOUSTON, TEX., Southern Pacific Bldg.  
TUCSON, ARIZ., Santa Rita Hotel Bldg.

CHICAGO, Marquette Bldg.  
DENVER, 435 Seventeenth St.  
SALT LAKE CITY, 705-6 Kearns Bldg.  
SEATTLE, Mutual Life Bldg.  
SAN FRANCISCO, Sheldon Bldg.  
LOS ANGELES, I. N. Van Nuys Bldg.  
HAVANA, CUBA, Calle de Aguiar 104.  
SAN JUAN, PORTO RICO, Royal Bank Bldg.

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### WATER TUBE STEAM BOILERS

**Babcock & Wilcox**

**Stirling**

**Babcock & Wilcox Marine**

**Rust**

### STEAM SUPERHEATERS      MECHANICAL STOKERS

36

Boiler practice has changed materially in the past ten years. Higher pressures and higher superheat have come into every-day practice and with these changes have also come larger units and higher rates of combustion, due to better stokers and furnace arrangement, better methods of feed water treatment, improved coal and ash handling apparatus and a better understanding of the care and operation of boilers. During this period great improvements have been made in the utilization of other fuels than coal. These developments have brought about a change in boiler room design and necessitate a much more careful study of the size of plant, service conditions, fuel, water, and class of boiler room help available.

By reason of the different factors involved the selection of a proper boiler unit is much more complex than in the past. Years ago this Company manufactured a line of so-called "standard" boilers; while these standards are still in existence, the sale of a standard boiler today is a rarity, for the reason that operating conditions cannot be even approximately standardized. Each and every prospective boiler sale is approached by this Company as an entirely new and independent engineering problem, the various factors involved determining the particular type, size and setting of boiler offered.

A very brief description of the different types of boilers manufactured by this Company is given on the following pages.

# THE BABCOCK & WILCOX CO.

## THE BABCOCK & WILCOX BOILER

The heating surface of the boiler is made up of drums extending longitudinally over the other pressure parts. To the drums there are connected, through forged-steel cross boxes at either end, the sections made up of headers and tubes. At the lower end of the sections there is a mud drum extending entirely across the boiler and connected to all of the sections. The connections between all parts are made by short lengths of tubes expanded into bored seats.

The headers into which the tubes are expanded are of forged steel and are of serpentine or sinuous form so that the tubes are disposed in a staggered position when assembled as a complete boiler. This staggering of the tubes breaks up the gases and causes them to impinge on every tube.

Opposite each tube end in the headers there is placed a handhole of sufficient size to permit the inspection, cleaning or renewal of a tube. These handholes are closed by suitable handhole fittings.

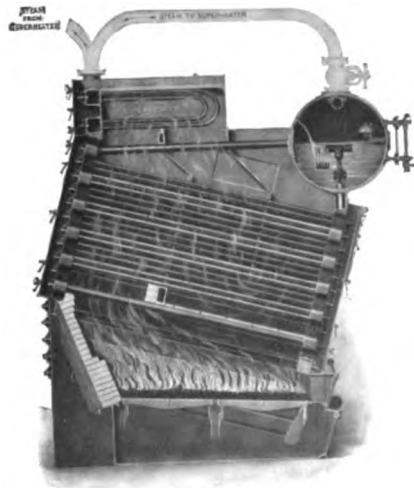
The gases of combustion are caused to make three passes over the heating surfaces by baffles constructed of special baffle brick and cast-iron flame plates.

The form of the furnace is such that it is readily adaptable to the fuel available, whether solid, liquid or gaseous.

Boilers are suspended front and rear from wrought-steel supporting frames, entirely independent of the brickwork.

Patented dusting doors furnish a means of keeping all portions of the heating surfaces free from soot and dust. Large doors in the sides of the setting give full access to all parts for inspection and for the removal of any accumulation of soot.

## THE BABCOCK & WILCOX MARINE BOILER



The Marine Type of Babcock & Wilcox boiler preserves the excellent features of the Land Type but adapts them to the conditions on shipboard. The tubes are usually of smaller diameter and are shorter than in the Land Type. The furnace increases in volume toward its exit and with its tile roof gives highly efficient combustion. The flame plates or baffles and the staggering of the tubes give the heating surface an efficiency unobtainable in any other boiler.

All parts subject to pressure are made of the highest quality of forged steel. No castings are used. The parts are as thick or thicker than the corresponding parts in cylindrical or Scotch boilers. The weight of the boiler, however, is less than one-half that of Scotch marine boilers for pressures above 200 pounds. There are Babcock & Wilcox marine boilers which have been in service for more than fifteen years which are still using the original tubes.

The Babcock & Wilcox marine boiler is especially adapted to the use of oil fuel. Where oil is burned, practically the entire surface of the furnace is composed of fire-brick, insuring perfect combustion.

(Continued on next pages)

(Continued from preceding pages)

## THE BABCOCK & WILCOX CO.

85 LIBERTY STREET, NEW YORK

### THE STIRLING BOILER

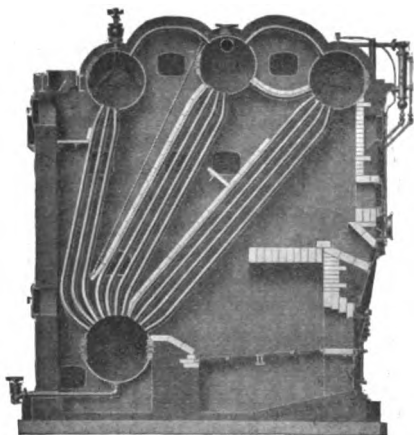
The Stirling boiler consists of three transverse steam and water drums set parallel and connected to a mud drum by three banks of water tubes so curved as to enter the drums radially. The steam space of the center drum, from which steam is taken, is connected to the front and rear drum by steam circulating tubes and to the front drum by water circulating tubes.

The tubes are so spaced as to allow the removal of any tube without disturbing any other tube or the brickwork.

The furnace is formed by the use of a firebrick arch sprung across the boiler setting in the triangular space formed by the front wall and the front bank of tubes. This furnace readily lends itself to the installation of any stoker and the burning of any class of fuel.

The gases of combustion are led from the furnace over the heating surface by two baffles of firebrick tile, one resting on the rear row of tubes of the front bank and the other supported on the rear row of tubes of the second bank.

The boiler is supported on a wrought-iron framework entirely independent of the brickwork setting.



Large cleaning doors in the sides of the setting give ready access to all portions for cleaning, inspection and repair.

### THE RUST BOILER

The Rust boiler is made up of two transverse steam and water drums and two transverse mud drums connected by banks of tubes. Each steam drum is connected to the mud drum directly below it by five rows of straight tubes and one row of curved tubes. The steam drums are connected by curved steam and water circulating tubes and the mud drums by water circulating tubes.

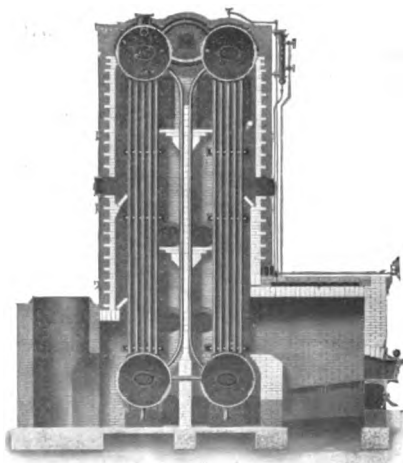
The tube sheets of all drums are pressed to form individual tube seats, thus permitting straight tubes to be expanded directly into the cylindrical drums. This construction is patented.

The tubes are staggered and are so arranged that any tube may be removed without disturbing any other tube or the boiler brickwork.

The furnace is of the extension or Dutch oven type and being distinct from the boiler setting proper, enables any type of furnace or any fuel to be used.

The gases are caused to make two passes over the heating surface by a vertical firebrick baffle built between and held in position by the central curved tubes. Horizontal baffle shelves cause all portions of the heating surface to be swept by the gases.

The boiler is supported entirely free of the brickwork on cast-iron saddles under the mud drums, the saddles resting on masonry foundations.



## THE BABCOCK & WILCOX CO.

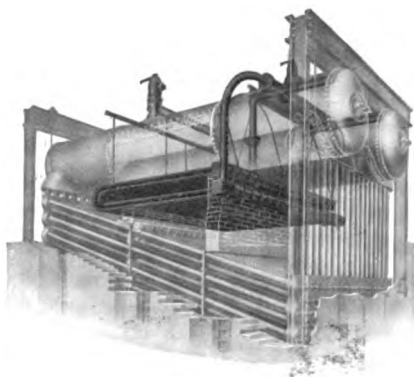
### THE BABCOCK & WILCOX STEAM SUPERHEATER

The Babcock & Wilcox superheaters, as built for installation in all boilers of The Babcock & Wilcox Co.'s manufacture, are similar in design, location and operation. The construction is modified in certain details to meet the specific requirements of individual boilers.

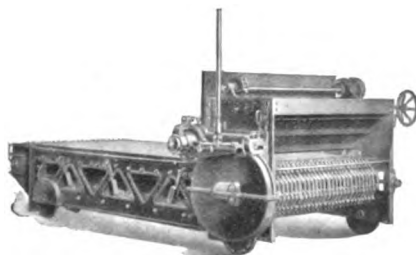
The superheater consists of two headers or manifolds, into which tubes bent to a U-shape are expanded. These headers are equipped with handholes and forged-steel handhole fittings, giving access to each tube end. As there is no rigid connection between the headers and because of the proper methods of suspension, there can be no strains set up in the apparatus by contraction or expansion. Each superheater is equipped with an independent steel-bodied, outside-spring, safety valve.

The superheater in all cases is located in the direct path of the products of combustion. The surfaces presented to these gases are smooth, offer the minimum resistance to the passage of the gases and the least opportunity for the adhesion of dust.

Steam is taken from the steam space of the boiler through the dry pipe, is introduced into the intake header and passes through the superheater tubes to the outlet header, to which the superheated steam connection from the boiler is made.



### THE BABCOCK & WILCOX CHAIN GRATE STOKER



The Babcock & Wilcox chain grate stoker consists of a grate in the form of an endless chain passing at the front and rear of the boiler furnace over sprockets which are keyed to shafts carried by the stoker frame. The passage of the grate through the furnace is continuous. The stoker is driven through a worm wheel keyed to the front sprocket shaft. The fuel is fed uniformly to the front end of the grate under an adjustable stoker gate. The volatile gases are driven off on the forward portion of the grate under an ignition arch and are completely consumed in passing over the incandescent fuel bed before striking the boiler heating surface.

Combustion is truly progressive. The ash and refuse are discharged automatically and continuously as the grate turns over the rear sprockets.

The form of the grate links is such as to allow proper admission of air for combustion. Suitable side seals and a bridge wall water box prevent the admission of large quantities of excess air. The bridge wall water box is connected into the water circulation of the boiler and is part of the regular stoker equipment.

The construction of the entire stoker is of such rugged character throughout as to permit continuous operation without the necessity of shut-downs for repair.

This stoker will only be offered for installation where fuel suitable for chain grate stokers is available.

**Over 20,000,000 horse power of boilers manufactured by The Babcock & Wilcox Co. are in use throughout the world.**

The Babcock & Wilcox Co. publishes the following books: "Steam," "Marine Steam," "The Stirling Water Tube Boiler," "The Rust Water Tube Boiler," "Steam Superheaters," and "Chain Grate Stokers," any of which may be obtained upon application to the nearest of the Company's branch offices.



# THE BIGELOW COMPANY

WORKS AND MAIN OFFICE

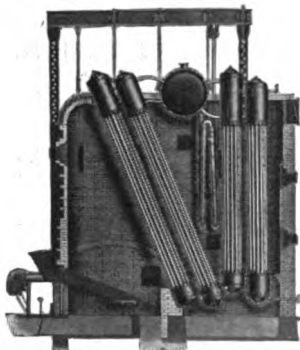
76 RIVER ST., NEW HAVEN, CONN.

NEW YORK OFFICE, 85 LIBERTY ST.

BOSTON OFFICE, 141 MILK ST.

SOUTHEASTERN OFFICE, Realty Building, CHARLOTTE, N. C.

Manufacturers of Fire Tube and Water Tube Steam Boilers, Digesters, Crystallizers, Vulcanizers, and Heavy Plate Steel Work



Bigelow-Hornsby Boiler

## THE BIGELOW-HORNSBY WATER TUBE BOILER

*Some of the features of the Bigelow-Hornsby Boiler that meet the requirements of Modern Power House Practice:*

1. Unlimited size of units.
2. Small ground space occupied.
3. Coldest water meets the coldest gases.
4. Direct heating surface about four times as great as the average water tube boiler.
5. All parts, both external and internal, readily accessible.
6. All boiler tubes perfectly straight.
7. Circulation of water and liberation of steam unrestricted.
8. Very dry steam, also ample room for superheaters where required.
9. High continuous economy due to extreme cleanliness of the most efficient heating surface.
10. Arrangement of baffling is unique, causing the gases to pass over the heating surface in thin streams and uniformly at every point.
11. Furnace arrangement is ideal for securing perfect combustion, as furnace is correctly shaped and of ample size.

12. Greatest flexibility, both as to construction and in steaming qualities.
13. No cast iron used in any portion of the boiler proper.
14. Constructed both as to workmanship and material in accordance with the most advanced boiler practice.

## THE BIGELOW-MANNING BOILER

This type of boiler can be constructed suitable for 200 pounds working pressure or more, in units up to 500 H. P. The shell sheets being away from contact with the fire permits the use of any thickness of shell necessary for high pressures. Another feature conducive to safe operation is the firm support of the boiler, which is accomplished in the Bigelow-Manning type by having a firm foundation upon which the cast iron base rests, without relying upon the support of setting walls.



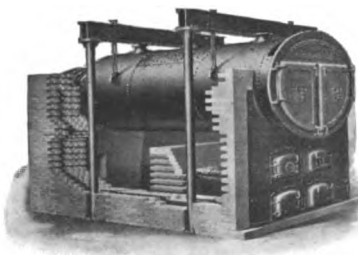
Bigelow-Manning

The economical evaporative performance of the Bigelow-Manning Boiler is remarkable. All radiant heat from the fuel bed is absorbed directly by water-heating surface, the distribution of the furnace gases over the heating surface is practically uniform, the superheat furnished is varied by changing the water level, there are no losses due to the infiltration of air in the setting and stand-by losses are comparatively small, occupying per H. P. much less ground space than other types.

## HORIZONTAL RETURN TUBULAR BOILER

The advantages of compactness and efficiency, large direct heating surface, easy cleaning, large liberating surface, perfect circulation and minimum liability and ease of repairs are well-known features of this type.

Our boilers are constructed in the most approved manner; we adopt the very highest type of professional and mechanical service, maintain the highest possible standard of efficiency, and believe our facilities for boiler construction are without a parallel.



Suspension Type of H. R. T.



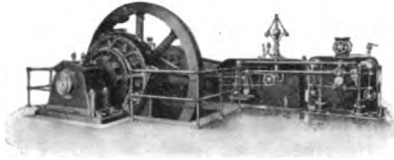


# THE BASS FOUNDRY & MACHINE CO.

Established 1853

FORT WAYNE, IND.

Manufacturers of Engines, Boilers, Heaters, Steel Plate Work, Rope Wheel Drives, Forgings, Car Wheels and Castings

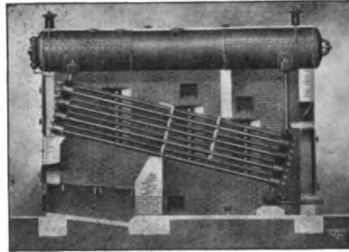
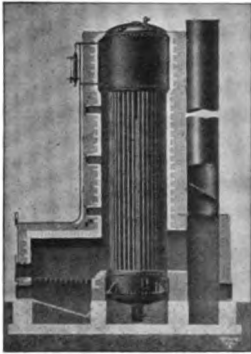


## HEAVY DUTY AND GIRDER FRAME CORLISS ENGINES

for

Factory, Rolling Mill and Direct  
Connected Service

Built in simple, tandem compound and cross compound types.



## HORIZONTAL AND VERTICAL TUBE BOILERS

In sizes from 50 to 1000 H. P.

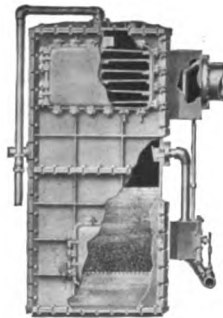


## HORIZONTAL TUBULAR BOILERS

SEND FOR A COPY OF

### "STEAM POWER"

Which illustrates the different types of Engines, Boilers, Heaters and other power plant equipment which we manufacture.



## OPEN FEED WATER HEATERS

Both Horizontal and  
Vertical

Either cast iron or steel  
construction.  
Built in all sizes.

# THE CASEY-HEDGES CO.

Founded 1889

CHATTANOOGA, TENN.

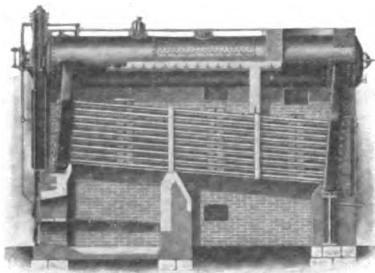
CHICAGO  
MEMPHIS  
DALLAS

NEW ORLEANS  
SEATTLE  
HAVANA, CUBA

NEW YORK  
BIRMINGHAM  
SAN JUAN, P. R.

**Manufacturers of All Types of Boilers and Plate Metal Work**

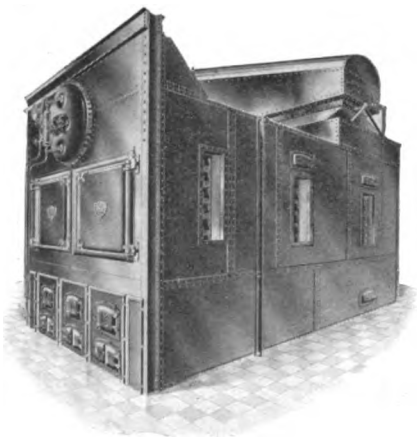
*Boilers built in accordance with A. S. M. E. Code when desired.*



**C-H Horizontal Water Tube Boiler,  
Vertical Baffle**

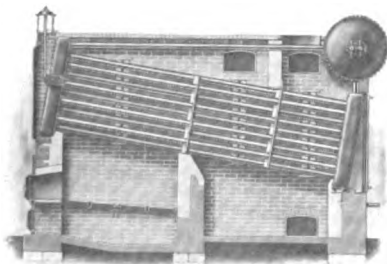
## **C-H HORIZONTAL TUBE BOILERS**

All steel construction. Built in units from 75 to 1000 H. P. Oval handholes with machined surfaces. With either Horizontal, Vertical or Combination Baffles. Large areas through water legs permitting rapid circulation. Boiler supported free from brick work by wrought steel supporting frame at front end; the rear by columns with expansion saddles and rollers.



## **C-H HORIZONTAL WATER TUBE BOILERS WITH STEEL CASED SETTING**

This type of setting entirely overcomes the defects of the brick setting, which consist chiefly of air leaks due to expansion and contraction; also reduces maintenance cost and decreases cost of foundations. Steel casings may be applied to either the Horizontal or Vertical Baffle types. The steel casing may also be used in conjunction with stokers.



**C-H Cross Drum Water Tube Boiler**

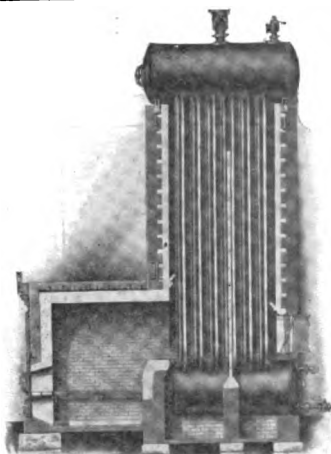
## **C-H CROSS DRUM WATER TUBE BOILER**

Especially suitable for installations where head room is restricted, such as basements and office buildings. Boiler is of sectional construction; may be shipped knocked down and parts taken through small openings. Built in sizes from 75 to 600 H. P.

# THE CASEY-HEDGES CO.

## C-H VERTICAL WATER TUBE BOILER

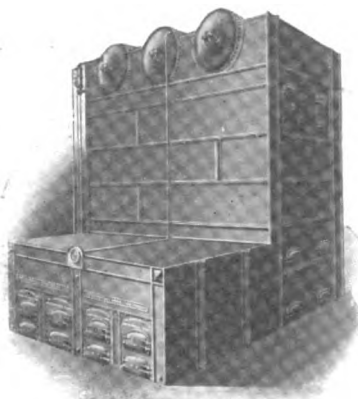
This boiler is of simple construction and very efficient. Consists of one or more upper drums, connected to one or more lower drums by a series of tubes placed in staggered rows. Baffles are set vertically in boiler and may be arranged for either two or three passes of the hot gases through the tube heating surface. Tubes enter drums radially, and are curved to an easy radius. Boiler is of unit construction; therefore, the size is unlimited. Furnace is of Dutch Oven construction.



C-H Vertical Water Tube Boiler

## C-H VERTICAL WATER TUBE BOILER WITH STEEL CASING

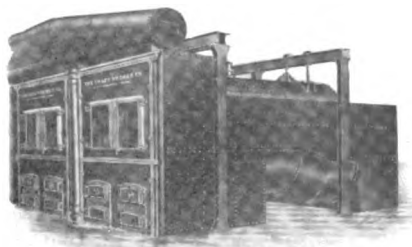
The C-H Vertical Water Tube Boiler is an ideal boiler when steel encased. A special design of steel casing is used, built in sections. Each section is provided with tie bar lintels that hold the wall in place, preventing buckling or bulging inward of the brick work. It is unnecessary to discuss the value of the steel casing, as it is well known.



C-H Vertical Water Tube Boiler with Steel Casing

## C-H HORIZONTAL RETURN TUBULAR BOILER WITH STEEL CASING

We originated the steel cased type of boiler setting, and have perfected three well-known types; viz., Standard, Full Dutch Oven and Semi-Dutch Oven. Steel Casing construction of heavy steel and braced with angles. Will save 33½% in brick work and 60% in foundations. The steel setting is absolutely air-tight; does away with expansion leaks in brick work; has practically no maintenance cost; assembled complete before shipping; may be installed by a novice.



C-H Steel Casing for Tubular Boilers



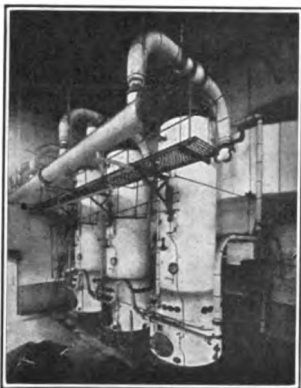
*Catalogue of the Casey-Hedges' Products Will Be Furnished on Application.*

## R. D. COLE MANUFACTURING CO.

Established 1854

NEWNAN, GEORGIA

Manufacturers of Boilers, Engines, Elevated Tanks, and Steel Plate Work



**COLE-MANNING BOILER.**—This type boiler is constructed in units up to 400 horse-power and for pressure of 200 lbs. or more. Boiler shell is supported on a one-piece cast iron base, which can be fitted with stationary or shaking grates. Smoke box provided with removable cast iron cover and provided with connection for all standard soot-cleaning devices. The evaporative performance, super-heating qualities and small floor space per horse power, contribute to make this type boiler a most desirable and economical unit.



**HORIZONTAL RETURN TUBULAR BOILER.**—These boilers are constructed in a most approved manner and of materials in full accordance with the A. S. M. E. Code. Standard settings can be provided with stationary or shaking grates and where increased efficiency and compactness is desired, standard steel casings can be provided for these settings. These boilers are designed with liberal proportions of heating surface, steam space and grate area, and within the limits of their usefulness are unsurpassed as steam generators. These boilers are constructed in units up to 250 horse power and for steam pressure of 200 lbs. per square inch.



**ELEVATED STEEL TANKS.**—Special designs for steel sprinkler tanks or domestic service will be furnished by our Engineering Department. Our elevated tanks are correct in design and the simplicity of the structure contributes to its low cost of maintenance. Sprinkler tanks and equipment are designed to incorporate the recommendations of all insurance authorities. Our facilities provide for the design and construction of all forms of steel plate work, including Stacks, Acid Tanks, Pressure Vessels, Structural Frames and Towers.

# EDGE MOOR IRON COMPANY

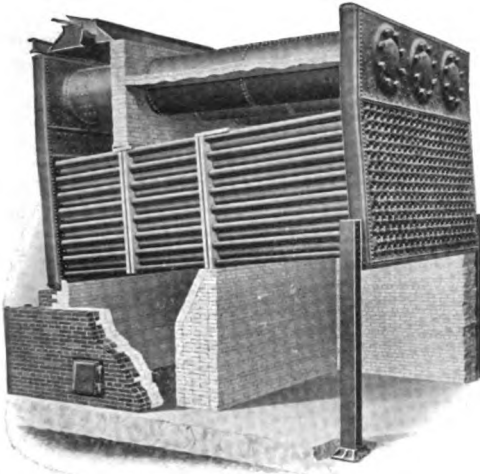
EDGE MOOR, DELAWARE

NEW YORK  
111 Broadway

BOSTON  
79 Milk Street

CHICAGO  
10 S. La Salle Street

Manufacturers of Edge Moor Water Tube Boilers



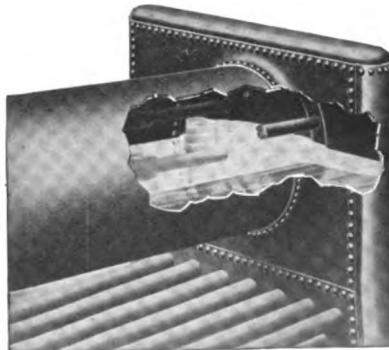
Note the special header construction, the horizontal drums, the elliptical handholes, the steel supports, and the efficient manner of baffling

When a boiler is desired for the exacting service of a modern power plant, the square feet of heating surface and the strength of parts are not the only important factors to be considered. While a boiler appears to be a simple piece of apparatus structurally, its internal performance is far more complex than is generally realized, and it is this complex action that warrants more attention to the details of design.

45

The special features of the Edge Moor boiler cannot be explained in the limited space of an advertisement. Those interested in steam boilers and in tests of unusual performance should send for our illustrated bulletins. They will also do well to ask for preliminary information from one of our sales offices before preparing the final specifications for a proposed plant, for by doing so, they will obtain valuable suggestions without any obligation.

Edge Moor boilers are built in sizes from 100 to 1000 horse-power.



The header construction provides such an increased steam-liberating area that boilers can be safely and efficiently forced to several times rated capacity



Write our nearest office.

## D. M. DILLON STEAM BOILER WORKS

Established 1870

Incorporated 1906

MAIN OFFICE AND WORKS: FITCHBURG, MASS.

NEW YORK OFFICE  
30 Church Street

SOUTHERN REPRESENTATIVE  
J. S. Cothran, Charlotte, N. C.

### We are equipped to furnish

#### BOILERS

For high pressure service, 150 to 200 lbs. working pressure; all fire tube types such as Horizontal Tubular, Straight Upright, Manning Upright, Locomotive and Marine.

#### STACKS

Guyed and Self-Supporting, any diameter and height.

#### TANKS

Any capacity, type, pressure or vacuum.

#### ROTARY KIERS

Special construction for all classes of work.

#### KIERS

Special construction for any class of work, high or low pressure.

#### VULCANIZERS

Special construction for various classes of work.

#### BOILER TUBES

All standard sizes; safe ending old tubes a specialty.

#### SMOKE FLUES

For any size or type of boiler, any thickness of material.

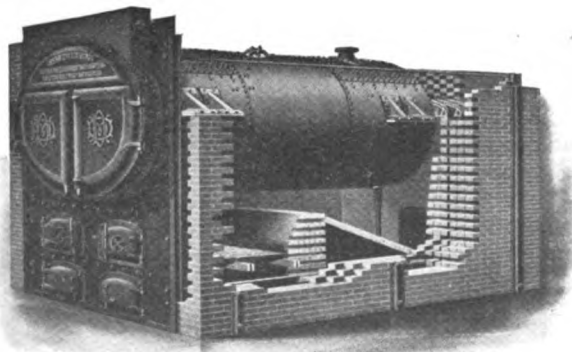
#### PLATE WORK

All kinds.

**High Pressure Boilers and Large Units**—To meet the increasing demand for higher pressures and larger units, we have gone carefully into the matter of thick shell plates and have found that when used in boilers of proper design and construction, they are perfectly reliable in every way.

We have built many horizontal return tubular boilers for 200 lbs. working pressure using shell plates  $\frac{3}{4}$ " thick, planed down to about  $\frac{1}{16}$ " at the girth seams, and the years of satisfactory service they have given prove that our contention as to the use of thick plates is correct; also that our design and construction methods are the best.

We build horizontal return tubular boilers in units from 10 horse power (24" diam.) to 600 horse power (108" diam.).



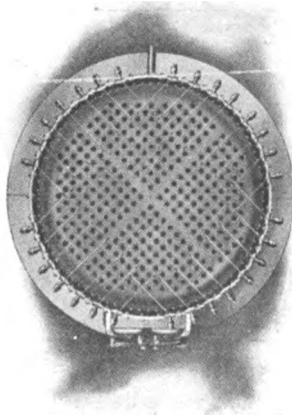
Horizontal Return Tubular Boiler

Illustration shows all steel boiler (nozzles, brackets, manhole covers, yokes, etc., all of steel) set with full overhanging steel front of special design. Note the tie rods above and below fire line; also stiffeners to prevent warping.

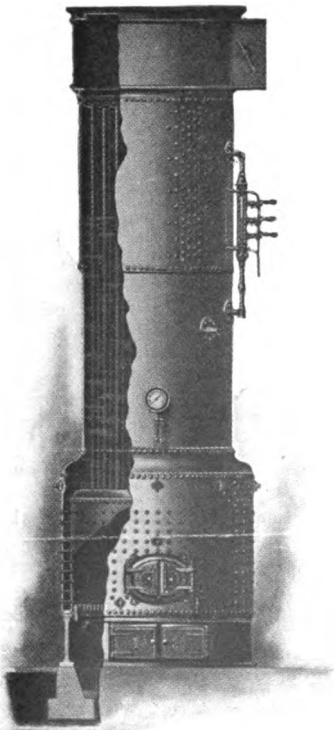
# D. M. DILLON STEAM BOILER WORKS

## MANNING BOILERS

The Manning type of upright boiler (see cut) is perfectly adapted to all the requirements of the highest pressures and the largest units, because no plate subject to tensile strain comes in contact with the fire. It is the best boiler for turbines on account of its ability to furnish steam superheated 25 to 50°; the amount of superheat may be increased by lowering the water line or by using longer tubes.



Horizontal Section of Manning Boiler, Showing Multiple Plan of Handholes



Manning Boiler, Showing Elevation and Section and Solid Cast Iron Base upon Which It Sets

It is well suited for any locality regardless of water conditions when made with the multiple plan of cleaning handholes which give access to every part of the crown sheet (see cut). The outside furnace plate is sometimes carried a little higher and a 12" x 16" manhole placed opposite the crown sheet, thus providing additional facilities for cleaning and internal inspection.

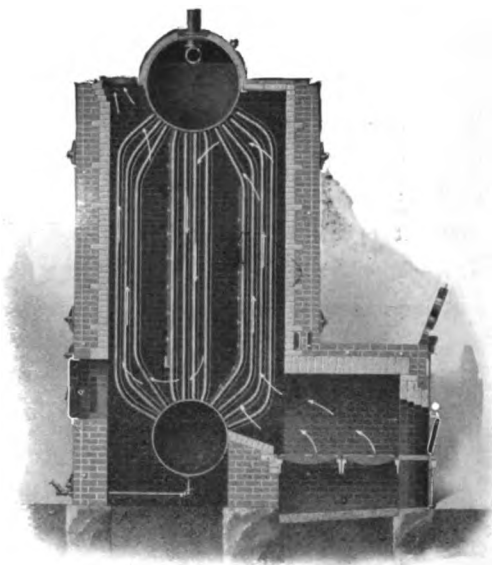
This boiler being self-contained, requires no setting; consequently the expense of maintenance is low, and the efficiency is uniformly high.

We build Manning boilers in sizes from 50 horse power to 500 horse power for any working pressure.

## ERIE CITY IRON WORKS

ERIE, PA.

Manufacturers of Steam Engines, Boilers, Feed Water Heaters and Tanks;  
Fire Tube and Water Tube Boilers of both Vertical and Horizontal Types



### THE ERIE CITY VERTICAL WATER TUBE BOILER

**Manufacture.** The boiler is made in well-equipped shops by a firm that has been making steam boilers for 76 years. The reputation, skill, experience and integrity of the Erie City Iron Works is put into every Erie City boiler.

**Simplicity.** Two drums placed horizontally one above the other and connected by a series of tubes; this constitutes the boiler. It has a minimum of internal contrivances; no handhole plates and no staybolts. Each tube may be easily removed and replaced. All parts accessible for easy examination.

**Safety.** A safe boiler—built on a factor of safety of five. There are no handhole gaskets to leak or blow out. Adequate shop and field inspection is provided.

**Capacity.** The steaming capacity of this boiler is exceptional, large overloads being the rule rather than the exception.

**Quality of the Steam.** Superior to that produced by any other boiler, in that the percentage of moisture in the steam is less than any other boiler.

**Circulation.** Its ample steam and water passages make free and unrestricted circulation and circulation is the secret of a successful boiler.

**Reliability.** The Erie City Vertical Water Tube Boiler is a dependable boiler. It possesses extreme flexibility of operation.

**Service.** Adaptable for any power service. Various types of furnaces and stokers may be used for burning coal, coke breeze, natural gas, crude oil, wood waste, bagasse and blast furnace gas. Also adaptable for the utilization of waste heats. Any superheater may be used.

*Write for further information*





# HEINE SAFETY BOILER COMPANY

ST. LOUIS, MO.

NEW YORK

BOSTON

PITTSBURGH

PHILADELPHIA

CINCINNATI

CHICAGO

NEW ORLEANS

SHOPS: ST. LOUIS, MO.

PHOENIXVILLE, PA.

Manufacturers of Heine Safety Water Tube Boilers, Heine Steam Superheaters, Steel Stacks, Housings, Flues, Etc.

## THE HEINE BOILER

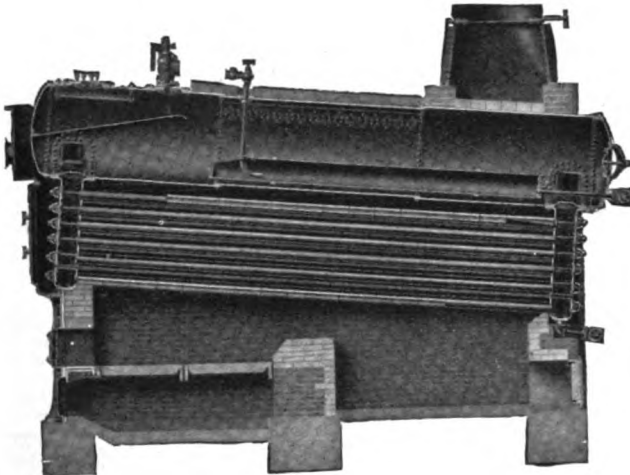


Fig. 1 Standard Single-Pass Design, in Small and Moderate Sizes

The Heine Boiler consists of three parts: the drum or shell, the front and rear headers and the tubes. It is built in a large variety of standard sizes and for all commercial pressures.

The partially consumed gases rising from the fuel bed are completely burned in the combustion chamber under the fire brick baffle placed on lower row of tubes and then pass parallel to the boiler tubes from the rear to the front of the boiler in one, two or more passes (see Figs. 1 and 2).

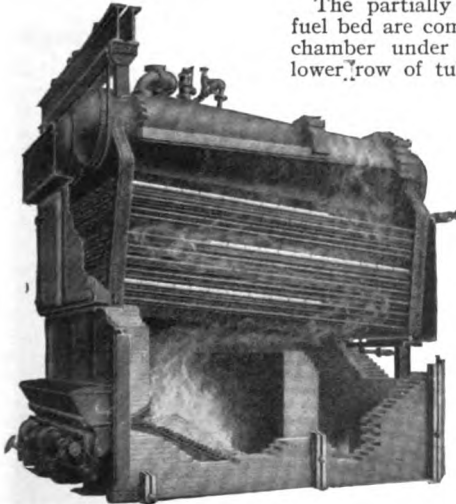


Fig. 2 Standard Two-Pass Design in Large Size and for High Capacity Stokers

The water is fed into the mud drum where the sludge is deposited and readily blown out. The water rises out of the drum as it is heated and circulates down the rear header through the tubes and up the front header. A free passage-way for the steam and water is provided by the large throat area at the junction of the boiler shell and the headers.

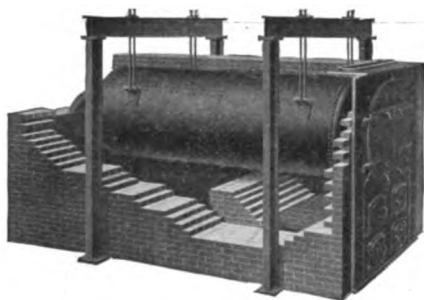
For further information regarding modern boiler practice, and the efficiency of the Heine Boiler, send for "Boiler Logic," "Superheater Logic" and our book "Helios."



# THE HOUSTON, STANWOOD & GAMBLE COMPANY

CINCINNATI, OHIO

Manufacturers of Steam Engines and Boilers. Heavy Duty Lathes



Boiler with Full Flush Front and Suspension Apparatus

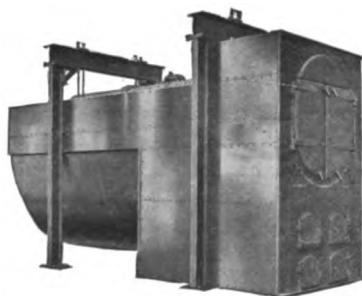
## HORIZONTAL TUBULAR BOILERS

We build all sizes of Horizontal Tubular Boilers up to 84"—20'—250 H. P. The 72", 78" and 84" diam. boilers in the 18' and 20' lengths are the most popular sizes and are also most efficient in respect to first cost per H. P. and operating efficiency. We especially recommend The American Society of Mechanical Engineers' Boiler Code to prospective purchasers as the boiler specifications contained therein embody good boiler practice.

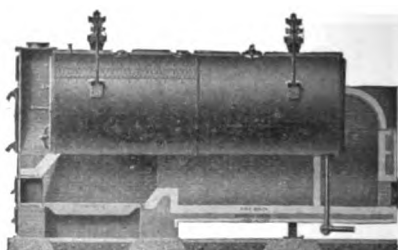
## STEEL CASINGS

The steel casing boiler setting is a steel jacket for the brick work which secures an improvement in the economical performance of the boiler plant through almost entirely eliminating air leakage through the walls, also greatly reduces the maintenance expense through largely avoiding the necessity of repairs to the brick work, the brick lining being held rigidly in place by the steel jacket. The style of steel casing illustrated is only one of the many designs of steel casings built by us.

50



Steel Casing Boiler Setting with Flush Front

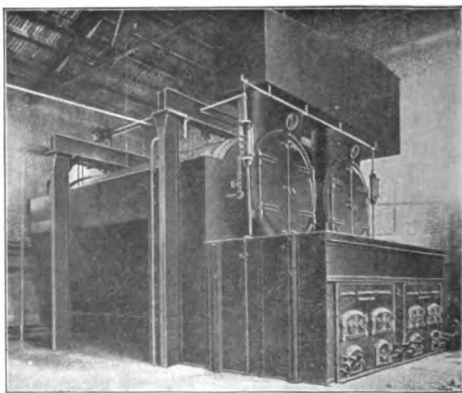


Sectional View Steel Casing Setting

The sectional view shows the relation of the brick lining and the insulating lining, the latter being placed immediately inside the steel plates of the casing. Through the use of insulating lining, such as diatomaceous earth, asbestos or other suitable material, the common brick ordinarily employed are almost entirely dispensed with, thus reducing radiation loss, the space occupied, the total weight and the amount of fuel required for raising steam when starting.

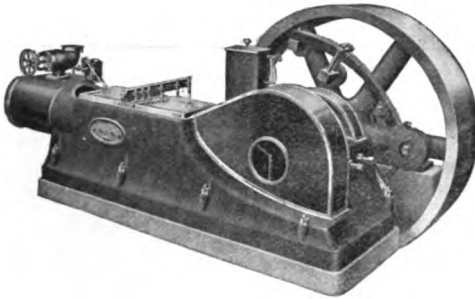
Illustration at right shows a battery of two boilers having steel casing settings. This installation happens to be equipped with dutch ovens for burning low-grade, high-volatile bituminous coal.

We also build locomotive firebox portable boilers, feed water heaters, smoke-stacks, heavy tanks and do a wide range of similar work.

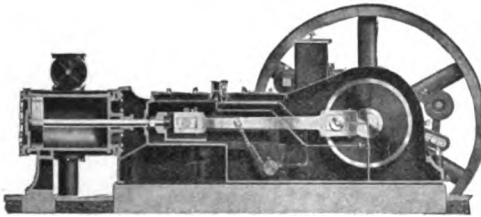


Installation of Two Boilers with Steel Casings

## THE HOUSTON, STANWOOD & GAMBLE COMPANY



Completely Enclosed, Automatically Oiling Engine  
with Shaft Governor



Sectional View

There is a considerable demand for a high-grade completely enclosed automatically oiling engine for direct connection to rotary pumps, fans, blowers, etc. For this class of service it is frequently preferable to operate the engine under control of the throttle or with a limit-speed throttling governor. When this is the case it is often desirable to have a hand adjustment for varying the cut-off (illustrated herewith). We also similarly equip center crank engines when preferred.

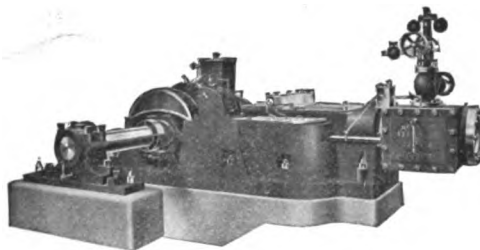
### OPEN TYPE ENGINES

Open Type Engines of the side crank style are built by us with single cylinder with capacities up to 350 H. P. or with twin cylinders up to 700 H. P. We build open type engines both simple and compound and equipped with either throttling or shaft governors. We build center crank open type engines up to about 100 H. P. The illustration shows a large size twin engine of about 500 I. H. P. Such attachments as link motion, gearing, hoisting drums, etc., are frequently furnished by us.

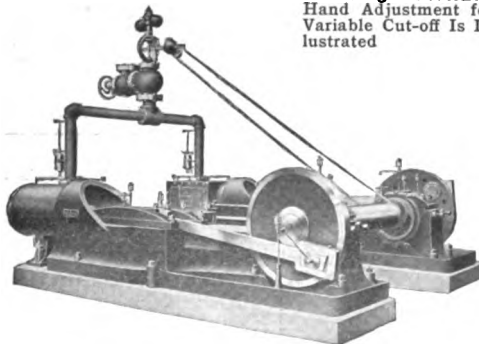
### 1. AUTOMATICALLY OILING ENGINES

We build completely enclosed, Automatically Oiling Engines with single cylinder in sizes up to 300 I. H. P. or in twin or cross compound styles, up to proportionately larger ratings. It will be noted that while all of the moving parts are readily accessible, yet even the valve gear is enclosed in such a way as to permit the bearings of the valve gear to be flooded with oil in the same manner as the other bearings are lubricated. Our line of enclosed engines includes the side crank style as illustrated, also includes the center crank style.

The sectional view will make clear our system of lubrication. The lubricating system is so designed that the piping is completely enclosed within the bed plate, so that it does not have to be shipped separately and attached at destination.



Completely Enclosed, Automatically Oiling Engine with  
Throttling Governor.  
Hand Adjustment for  
Variable Cut-off Is Il-  
lustrated



Heavy Duty, Open Style Twin Engine, with Throttling  
Governor

## THE GEORGE T. LADD CO.

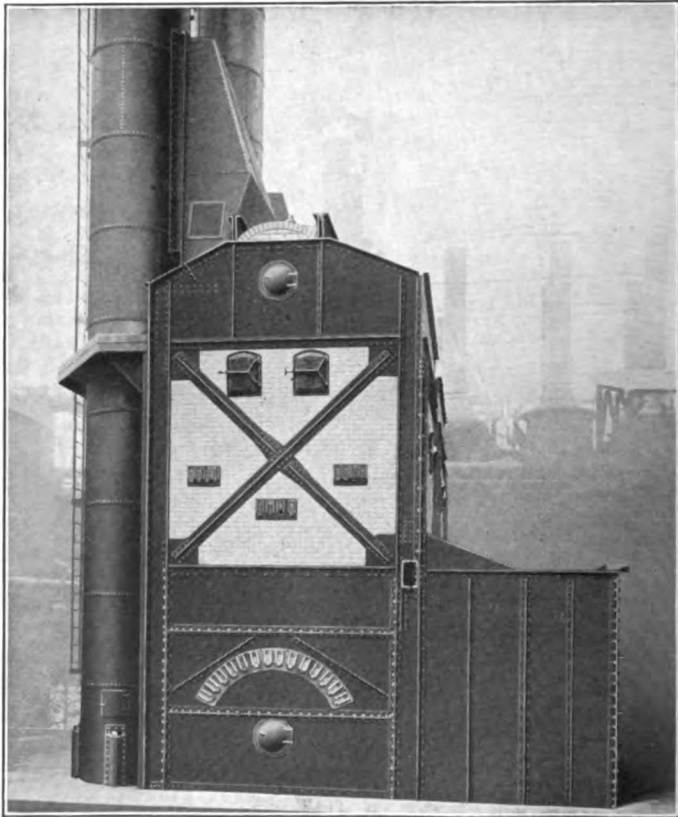
GENERAL OFFICES

1620 FARMERS BANK BLDG., PITTSBURGH, PA.

Manufacturers of the LADD Water Tube Boiler

**LADD**  
WATER TUBE BOILER

PATENTED—OTHERS PENDING



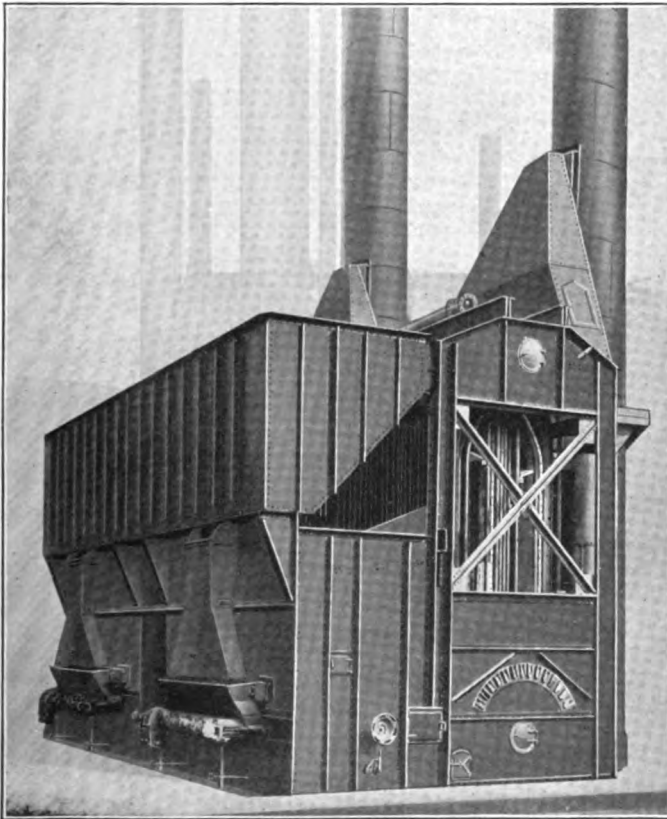
**500 Horse Power Boiler with Stack Attached to Boiler Suspension**

The LADD Water Tube Boiler is of special interest to purchasers who are in search of apparatus having high operating efficiency and low cost of upkeep. It has been standardized and designed particularly with these two points in view and an examination of its substantial construction will convince the engineer of the lasting and efficient qualities of the LADD type of setting. It can be built in any size up to 3000 H. P. in a single setting, to suit any service and to fit varying space requirements.

## THE GEORGE T. LADD CO.

The boiler is built either with the Dutch oven or high arch type of setting, dependent upon the type of stoker, degree of overload required, etc. All tubes are bent to same radius, easily removable (no handhole plates) and arranged in staggered rows.

All brick are standard and the setting so designed that it is unnecessary to use cut brick. The brickwork construction eliminates all possibility of air leaks or cracks. The suspension is actually outside the brickwork and all loads due to boiler arch thrusts, stack and superheater, are carried on the suspension. The design of the suspension frame readily accommodates itself to the support of additional loads such as coal bunkers, walkways, etc., while the stack, if desired, can be supported from the ground without flaring of the base or the use of



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**500 Horse Power Boiler, Stoker Fired, Coal Bins Attached to Boiler Suspension**

guy lines, by passing it through a horizontal girder at the rear top of the suspension frame (see illustration).

By means of an ingenious device employed in the lower drum, segregating several rows of the rear bank of tubes, the feed water is directed upward in these segregated tubes, thus providing a combined purifier and economizer effect, at the same time maintaining a positive circulation under all degrees of rating.

**WRITE FOR CATALOG NO. 17**

*List of Prominent Users Furnished upon Application*

# E. KEELER COMPANY

Established 1864

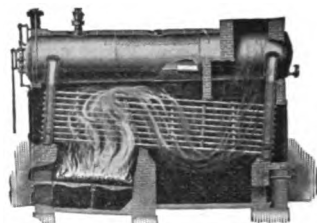
WILLIAMSPORT, PA.

NEW YORK BOSTON PHILADELPHIA PITTSBURGH CHICAGO CLEVELAND RICHMOND  
SAN FRANCISCO

**Manufacturers of Water Tube and Tubular Boilers. Steel Plate Work**

## KEELER WATER TUBE BOILERS

**Standard Type:** The arrangement of furnace, tubes, headers and drum in the Keeler Water Tube Boiler is efficient, accessible and compact. The superior efficiency of the Keeler Boiler rests upon correct proportions of heating and grate surface for the character of fuel to be burned, ample height of furnace, a superior arrangement of baffle walls and a perfect circulation. Every portion of the heating surface is accessible for both external and internal inspection, making it impossible for soot or scale to accumulate undetected. There is ample room between tubes and drum for inspection or repairs. Special side cleaning doors make it possible to observe the condition of the outside surface of the tubes. There is no part of the interior surface that cannot be examined and cleaned.



Standard Type Water Tube Boiler

Keeler Water Tube Boilers are usually built complete and tested in the shop. This reduces the cost of erection, as the boilers are handled as a unit. It also eliminates the dangers due to careless assembling of boilers in the field and makes the erection merely a matter of placing in position and attaching fittings.

Built in units 75 to 1500 H. P.

**Cross Drum Type:** The Keeler Cross Drum Water Tube Boiler is a modification of the standard design, only in the length and location of the drum and the method of connecting it to the headers. This type was developed to meet the demand for a high pressure water tube boiler that could be installed in Office Buildings, School Houses, Churches, Apartment Houses, Hotels and boiler rooms generally where ceiling height is limited or where the boiler must be introduced through narrow passageways or restricted openings.



Cross Drum Type Water Tube Boiler

The pressure parts of the boiler are shipped in a knocked-down condition, making it possible to install it without cutting through walls and floors in locations that would be wholly inaccessible for almost any other type of boiler. If boilers are to be exported, the cross drum boiler can be handled at much less expense by steamship companies on account of its reduced bulk in a knocked-down condition, and the comparatively small weight of the heaviest piece.

Built in units 60 to 1000 H. P.

## KEELER HORIZONTAL RETURN TUBULAR BOILERS

Our Return Tubular Boiler is the product of fifty-three years' experience of boiler building. Tube holes are drilled from the solid plate, and not punched small and reamed to size. All seams are thoroughly caulked on the outside, and the end of butt straps are caulked on the inside. Braces are drop-forged. Steam and safety valve outlets are provided with forged weldless nozzles faced and drilled extra heavy. Manhole plates, yokes and brackets are of pressed steel. All boilers built to A. S. M. E. requirements.



Horizontal Return Tubular Boiler

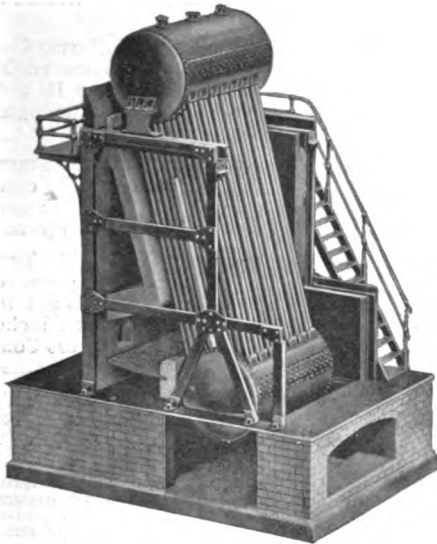
**FIFTY-THREE YEARS OF BOILER BUILDING**

**Ask for Catalogs**

# JOHN MOHR & SONS

349-359 W. ILLINOIS ST., CHICAGO, ILL.

**Manufacturers of the Garbe Water Tube Boiler, Blast Furnaces, Steel Ladles, Hot Stoves, Cupolas, Furnaces, Mixers, Converters, Sterilizers, Etc.**



**Garbe Patent Water Tube Boiler**

## THE GARBE BOILER

### Special Advantages

All handholes with their troublesome and expensive gaskets are eliminated, as the tubes are expanded into very large drums which are equipped with the patented pressed "Garbe" Plate. Any tube can easily and quickly be inserted, removed and replaced without disturbing any of the others.

Elimination of all flat surfaces, stay bolts and braces. All parts of Boiler are cylindrical and curved.

All tubes are absolutely straight and nearly vertical, therefore the entire circumference of tube is directly exposed to the gases. The effective heating surface is materially larger than that obtained by horizontal tubes.

The upper drum is suspended from a substantial structural frame work, absolutely independent from the mason work. The lower drum is in contact with two slides or guides, thereby allowing free expansion of tubes, equalizing the strain between drums and reducing chances of leakage to a minimum.

The vertical arrangement of tubes allows the steam to develop very freely and to flow by the shortest way possible without changing direction to the upper drum, thereby causing a very rapid circulation. The tubes are distributed over the full length of the Boiler, thus giving a large and uniform steam-liberating surface, equal to the full area of the tubes. This vertical arrangement of tubes will do away with local overheating and consequent rupture of the tubes so often occurring in horizontally arranged tubes.

Soot, dust and ashes cannot accumulate on tubes or any part of drum, thereby allowing longer periods of operation without the necessity of cleaning.

Large water capacity, due to the extremely large size of upper and lower drum, insuring a more constant water level than any other boiler.

The feed water passes through the rear bank of tubes, which have the lowest temperature, to the lower drum and deposits therein all impurities.

Over half of the entire heating surface is effective in liberating steam.

Practically no scale in tubes owing to rapid circulation and vertical tubes.

## MURRAY IRON WORKS CO.

1870

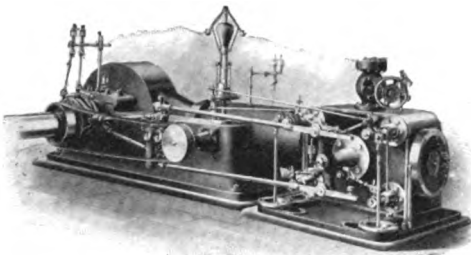
1917

BURLINGTON, IOWA

Complete Power Plants—Corliss Engines—Boilers of All Types—Air Compressors, Pumping Engines, Feed Water Heaters, Rocking Grates

### MURRAY CORLISS ENGINES

Murray Corliss Engines are built either with girder frame, tangye frames or rolling mill frames of our patented design.



The Standard Murray Corliss is a girder frame engine built in sizes up to 18 x 42 inches, and capacities ranging from 50 to 600 H. P.

Murray Tangye Frame Corliss Engines for extra heavy duty are built in sizes from 16 x 36 inches upward.

Our Rolling Mill Type Frame for high pressures and high speeds is built for engines from 12 x 24 inches

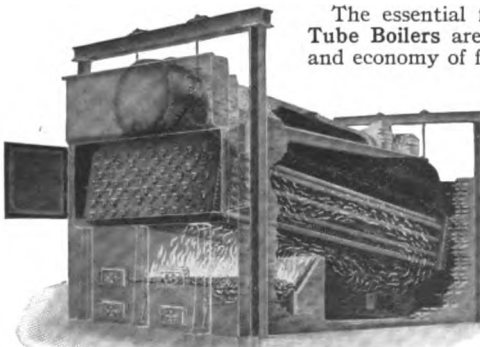
**Murray Rolling Mill Type Corliss Engine**

upwards. Capacities range from 100 to 1300 H. P. Tandem and Cross Compound Engines are built for any load required.

■ **Murray Minor Corliss Engines**, 20 to 70 H. P., are suitable for the smaller mills and factories. *Ask for Catalogue No. 65.*

Points of Superiority: A. Excellence of materials. B. Best workmanship. C. Rigid inspection. D. Superiority of design in the following particulars of detail: 1. The latest and most approved forms of frames, suitable for every purpose. 2. High speed, ball-bearing governor with improved safety stops. 3. A form of cylinder whereby the exhaust passages are insulated from the cylinder by a dead air space. 4. Improved valve motion. 5. Improved dash pots, under the cylinder plate, or bolted to side of cylinder. 6. Improved forms of steam and exhaust valves. (Double ported when specified.) 7. An improved form of piston. 8. Fly wheels made in halves, free from initial strains. 9. Vertically adjustable outer pillow block with oil-retaining rim. 10. Broad pyramidal main bearing and cylinder feet or sole plates. 11. New and improved style connecting rod. 12. Improved cross head with adjustable shoes running in bored guides. 13. Smallest possible clearance volume.

### HIGH PRESSURE MURRAY BOILERS



The essential features of the Murray Water-Tube Boilers are safety, simplicity, accessibility and economy of fuel and space. They are of the

straight tube, all steel type, no cast iron being used in any part subject to tensile strain. They are made up of front and rear headers connected together with wrought circulating tubes and a top steam drum or drums, the whole set with an incline to the rear in an inexpensive bricksetting, those of 200 H. P. capacity and over being supported independently of the brick work by a cast iron column and steel girder gallow's frame as shown.

**Murray Water-Tube Boiler, with Suspension Rigging**

We do not confine our customers to one type, but build the Tubular, the Water-Tube and the Internal Furnace. These different types of boilers are described in the following: Water-Tube—*Catalogue No. 60*; High Pressure Horizontal Tubular—Series "D," *No. 4 Pamphlet*; Standard Horizontal Tubular—Series "D," *No. 6 Pamphlet*; Scotch Marine—*No. 75 Pamphlet*; Vertical and Portable—Series "D," *No. 10 Pamphlet*.



# MURRAY IRON WORKS CO.

## MURRAY DUPLEX INTERNALLY FIRED BOILERS

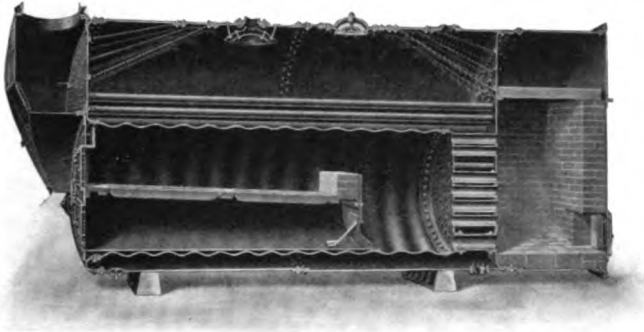


Fig. 1

### A Different Principle of Circulation

The special feature of the Murray "DUPLEX" boiler is covered by letters patent No. 1,151,127 and this improved form of construction can only be used by the Murray Iron Works Company. The "Scotch" boiler as built heretofore, while nearly the ideal boiler for economy of fuel and space, had one decided weakness, namely, poor and unequal circulation. Owing to the location of the flues and the furnace the heat travels as shown in Fig. 2, and the lower part of the boiler is always cold, so cold, in fact, that in many cases, you can safely put your bare hand on the bottom of the shell because all the heat of the fire is transmitted to the water in the upper half of the boiler.

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This unequal heating has two serious drawbacks; first, the water in the lower part of the boiler being dead, only that above the furnace is in circulation, thus materially cutting down the capacity and efficiency of the boiler; second, the extreme difference in temperature between the top and the lower part of the boiler generally causes it to leak in the girth seam.

Fig. 2 correctly represents the fire travel and water circulation in the ordinary types of "Scotch" boilers.

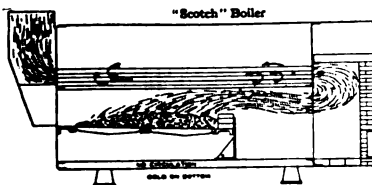


Fig. 2

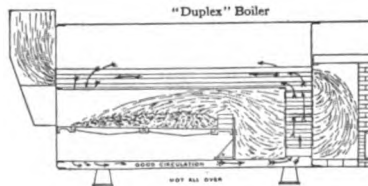


Fig. 3

In the Murray "DUPLEX" boiler the circulation is similar to that in an externally fired boiler. Our boiler becomes hot all over, setting up a rapid circulation and overcoming all unequal expansion and contraction in the shell and furnace. You would need an asbestos mitten for safety if you placed your hand anywhere on the bottom of our boiler. Note the difference in circulation between a "Scotch" boiler and the Murray "DUPLEX" boiler as shown by Figs. 2 and 3.

"DUPLEX" Internally Fired Boilers are built in sizes of 50, 75, 100, 125, 150, 200 and 250 H. P.

**These Boilers are Practically Smokeless**

## PAGE BOILER COMPANY

GENERAL OFFICES:

815 TO 819 LARRABEE ST., CHICAGO, ILL., U. S. A.

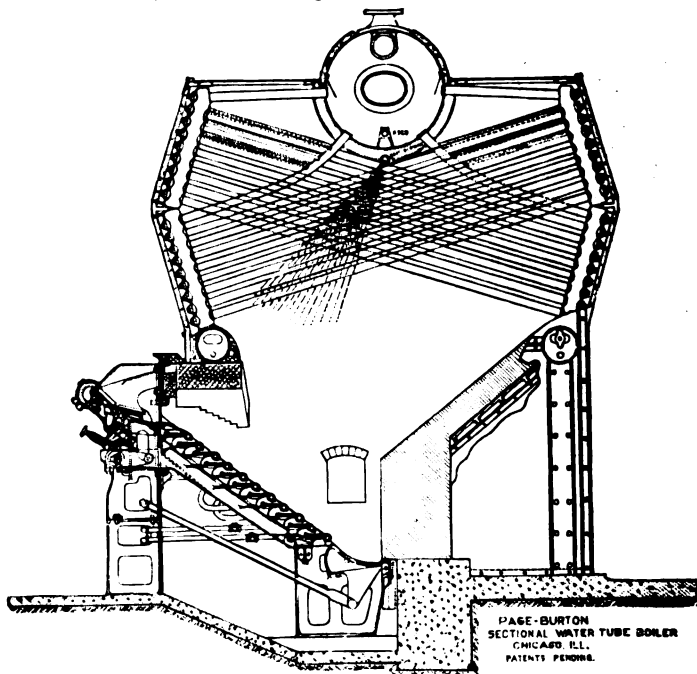
Manufacturers of Water Tube Sectional Steam Boilers

### PAGE-BURTON WATER TUBE SECTIONAL STEAM BOILERS SELF-CONTAINED

Built for Any Space Conditions. Largest Power. Small Space.  
Highest Efficiency. Absolutely Safe. Long Life.

The Page-Burton Water Tube Boiler is self-contained. The steel enclosure is lined with air cell asbestos and fire brick. Air leaks are not known in this enclosure.

Boilers adapted to any type furnace—due to its sectional design, all material can be delivered into an opening 4 ft. by 4 ft. Largest power, smallest space. No trouble to keep boiler free from sediment inside and soot outside. The Page-Burton Boilers are equipped with our oscillating soot blowers. All sections blown in one minute, not a door to open.



The large mud drums are truly settling chambers and when properly handled the boilers may be washed out as quickly as a tubular type boiler.

Trouble is an unknown factor in the Page-Burton Boiler, built for any pressure desired.

Send for our new catalog. Patents pending.

Note large combustion area directly beneath the entire tube surface, every inch of water heating surface effective, gases are split up vertically and horizontally. Bafflings are at top which causes gases to expand as they pass around the steam drum, the best possible efficiency is obtained.

# SPRINGFIELD BOILER CO.

SPRINGFIELD, ILL.

Builders of "Springfield" Boilers

## "SPRINGFIELD" WATER TUBE BOILERS

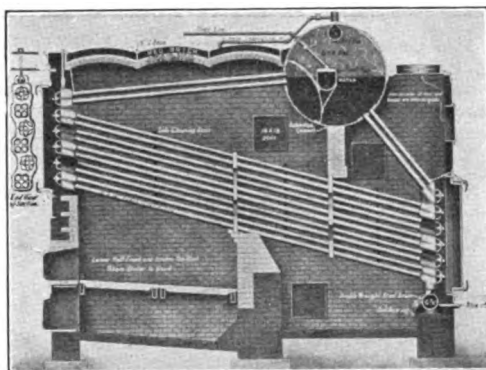
Sectional-Sinuuous Headers

NO Staybolts

NO Braces

NO Bent Tubes

ALL STEEL Construction



Side Elevation

Illustration shows a complete section of the "Springfield" Water Tube Boiler in place, with the front header suspended and the rear resting on a ball bearing. This construction allows the header to come and go from any direction, relieves it from all strain, and does away with the wear and tear that is sure to follow in a boiler where the joints are rigid. The front headers hang from suspension rods. There are no riveted seams where the header is connected to the drum, as in water-leg boilers.

The 3-inch tubes are placed at an angle of 15 degrees. This gives rapid and perfect circulation. They are in groups of four, with one *hand-hole* to each group. Two-thirds less hand-holes than in any other horizontal water tube boilers; this greatly facilitates and lessens cost of cleaning. Hand-holes have *inside steel plates*.

Each section is connected to the steam and water drum by four tubes; this gives very large liberating area, evenly distributed over the entire length of the drum. This insures perfect circulation. Drum of large diameter and special dry pipe insures dry steam.

Baffles are made of cast iron, with open face and cast iron sleeves, through which the tubes pass. They are filled with fire clay and cement, held in place by flame bars, and form a solid wall. They are indestructible. Permit removal of any tube without disturbing other tubes or baffles.

Tubes are staggered in such a way as to allow the gases to completely surround them. This allows a thorough mixture of the gases of combustion.

Boiler is very compact; occupies less space than any other boiler of like capacity and requires less brick for its setting; approximately 97 per cent of the total heating surface is *in the tubes*.

## "SPRINGFIELD" INTERNALLY FIRED BOILERS

with Corrugated Furnaces, have many valuable features to recommend them both to the Engineer and to the user. They are rapidly becoming adopted everywhere for both power and heating purposes. *Economical* in the use of fuel, floor space occupied, head-room, repairs, and because they are easy to clean.



TRADE MARK

Write for pamphlets and further data



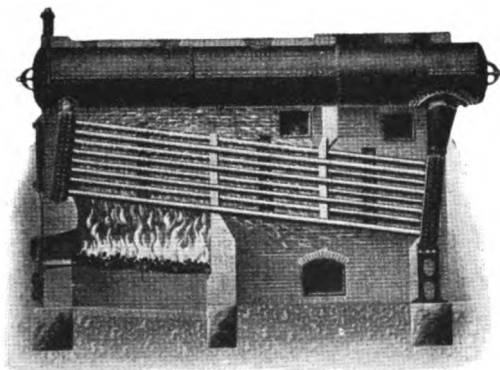
# UNION IRON WORKS

ERIE, PA.

Manufacturers of Steel Boilers

Branch Offices and Representatives in Boston, New York, Philadelphia, Syracuse, Buffalo, Cleveland, Pittsburgh, Toledo, Detroit, Chicago, St. Louis, Kansas City, and San Francisco

The Union Iron Works have been building Boilers for twenty-seven years, starting with a modest beginning, and growing with the times until we now cover about five and one-half acres. We build a complete line of Boilers, including practically all types of Fire Tube Boilers as well as our "Union" Water Tube Boiler, and do all kinds of sheet plate work, such as stacks, tanks, etc.



## THE "UNION" WATER TUBE BOILER

is the product of all these years of Boiler building experience, and embodies more theoretical and practical features for safety and operating efficiency than any other Water Tube Boiler. It has the necessary flexibility to relieve the Boiler of the injurious internal strains and still maintain areas for unrestricted circulation. This is accomplished by our patented corrugated flange connection from drums to headers. It will give greater continued operating efficiency by reason of keeping the heating surfaces clean while in service. Our patent purifier entirely out of the fire line and path of circulation, prevents deposits on the water side of the heating surfaces. The tube spacing and cleaning facilities provided keep the Boiler clean on the fire side while in operation. The practical construction of our handhole plate and yoke is also a distinctive "Union" feature. Proper proportions of uptake areas and baffling give "Union" Boilers good combustion and proper transfer of heat to the water contents, with resulting low uptake temperatures. Horizontal drums giving large water contents and steam liberating surface permit of sudden steam demands and high overloads with dry steam.

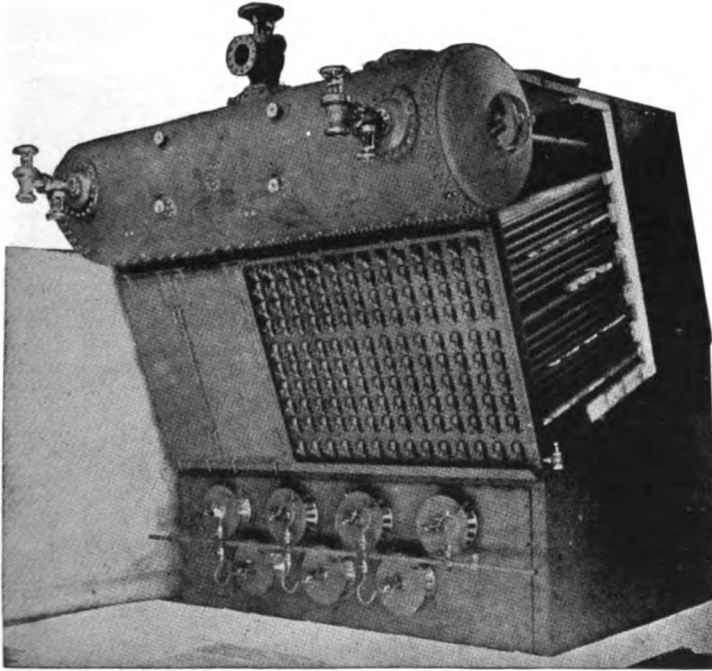
The standard Boiler is suitable for stoker and superheater equipment and is made in large sizes for high pressure. To quote a remark made at the conclusion of a recent efficiency test by the supervising engineer of a large corporation: "The high efficiencies obtained after more than a year's service on these 500 H. P. Boilers as well as the total absence of mechanical trouble prove both the correctness of design and quality of workmanship." There are thousands of horse power in successful and satisfactory use. Catalogues and data are cheerfully furnished, or representative from one of our offices will call with detail information on request.

*Condensed specification and engineering data cards especially prepared for consulting and designing engineers free on request.*

# THE CHARLES WARD ENGINEERING WORKS

CHARLESTON, W. VA.

Manufacturers of Water Tube Boilers and Marine Engines



61

## WARD'S WROUGHT STEEL MARINE BOILER

Improved and Most Rapid Circulation

Generating Tubes Expanded

No Other Joints

No Nipple Connections

No Staybolts

Illustration shows Ward Boilers for U. S. Supply Ship "Bridge,"  
4275 Square Feet Heating Surface Each.

Contract Awarded as Result of Evaporative Trials  
by United States Naval Board.

*16.73 Pounds Water per Pound of Oil*

*81.68 Per cent Efficiency*

Built in 60 standard sizes, ranging from 1700 to 5000 S. F. H. S.

## **HENRY VOGT MACHINE CO.**

LOUISVILLE, KY., U. S. A.

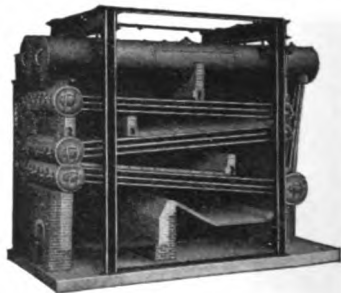
**Manufacturers of Ice and Refrigerating Machines, Water Tube and Other Boilers, Sectional Steel Casings, Down Draft Furnaces, Shaking Grates, Drop Forged Valves and Fittings, and Drop Forgings**

### **VOGT WATER TUBE BOILERS**

The Vogt Water Tube Boiler is constructed to meet the demand for a strictly safe, durable and efficient steam generator, and is free from many objectionable features commonly found in other types of boilers.

Look at the cut for the obvious advantages of Vogt construction:

- Wrought-steel throughout.
- No flat stayed surfaces.
- Accessibility for cleaning and inspection.
- No multitude of hand-hole plates.
- Rapid circulation.
- Complete combustion.
- Dry steam.
- Steadiness of water level.
- Flexibility of construction.



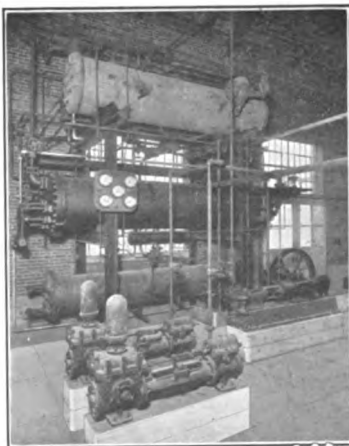
**Section Showing Advantages of Vogt Water Tube Boiler Construction**

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### **VOGT RETURN TUBULAR BOILERS**

The Vogt Return Tubular Boiler is of unusually strong construction, being made of the very best quality of flange or firebox steel, for insuring long wear and withstanding high pressure. The tubes are either lap-welded or seamless steel. The larger sizes have longitudinal seams, triple or quadruple riveted double butt strap joints. All flat surfaces are properly stayed with solid steel stays.

### **VOGT ICE AND REFRIGERATING MACHINES**



**Installation Louisville City Hospital  
20-Ton Exhaust Steam Refrigerating  
Machine**

#### **Absorption System**

The simple construction of the Vogt refrigerating machine is one of its many superior features.

They are built in sizes from 8 to 300 tons refrigerating capacity, and can be installed as an isolated unit or in connection with any type of power plant where steam is available.

It consists of Generator, Aqua Ammonia Pump (either single, direct acting or fly-wheel type), Absorber, Exchanger, Rectifier, Condenser and Weak Liquor Cooler (either horizontal tubular, atmospheric or double-pipe type, depending upon water temperature and conditions).

Only one running part, the ammonia pump, makes the Vogt Absorption Machine the simplest, most economical and durable.

# THE WICKES BOILER COMPANY

MAIN OFFICE AND WORKS, SAGINAW, MICH.

Sales Offices in Principal Cities

Manufacturers of Steam Boilers

## WICKES VERTICAL WATER TUBE BOILERS AND STEEL CASED BOILER SETTINGS

Water Tube Boilers have proved their efficiency. The need is for very simple water tube boilers. The Wickes Vertical Water Tube Boiler has proved its superiority. **FIRST:** *It is constructed entirely of homogeneous material and uses straight tubes.* **SECOND:** *It operates with high commercial efficiency—the sum of all efficiencies.*

Two 12 x 16-inch manholes open in this boiler—one top—one bottom, inspection and cleaning is a simplified matter. Every tube can be looked through, washed or scraped.

It is easy to clean. If you have ever cleaned a boiler and lamed your back, bruised your knees, and skinned your elbows, you will appreciate the accessible construction of this boiler. Two men can open, turbine and close the Wickes Vertical Water Tube Boiler in ten hours. You know how long it takes to clean some boilers. A clean boiler promotes efficiency. A boiler easy and quick to clean is likely to be cleaned often and well—that is human nature. When your boilers—any of them—stand idle there is a considerable investment upon which you must charge interest that is not earning money—that is not contributing its share to the profit of your Company. On the contrary it is a drag.

The overhead and the unit cost of power is low when using this boiler, for it can always be in service.

**High furnace temperature** results from Dutch oven. Gases entirely surround and closely scrub heating surface from entrance to release. The gases cannot leave the heating surface. There is no possible chance for short-circuiting. The boiler heating surface absorbs the heat—empty pockets in setting lose heat. There are no empty pockets in this boiler. The **steel cased settings** are always tight, no cracked, warped, leaky, defective and unsightly settings exist with this type. A steel cased setting is a simple and sure cure for air infiltration losses. The largest preventable losses we have to contend with in boiler efficiency are excess air losses. A **very long gas travel**—hence long contact with heating surface is provided. Heat absorption is, therefore, assured.



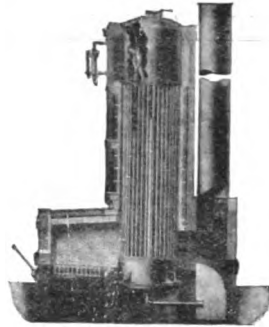
Steel Cased Setting

Did you ever wreck an engine by pulling water over into it from the boiler? Study this boiler. The steam drum gives great height from water line to steam outlet nozzle. This height provides room for separation of the steam from the water which is entrained with it at a point close to the surface of liberation. Since the shell is subject to a mild degree of heat some superheat is effected on the steam leaving this boiler. You do not pull water over from this boiler.

The concentration of the greatest amount of power per square foot of floor space yet achieved can be attained using this boiler.



Are you interested in producing boiler horsepower hours per annum cheaply? If so, ask us for particulars.



Cut Shows Position of Man Cleaning. He Stands Erect. Is It Laborious Compared with Usual Forms?



Quick Steaming, Delivering Dry Steam

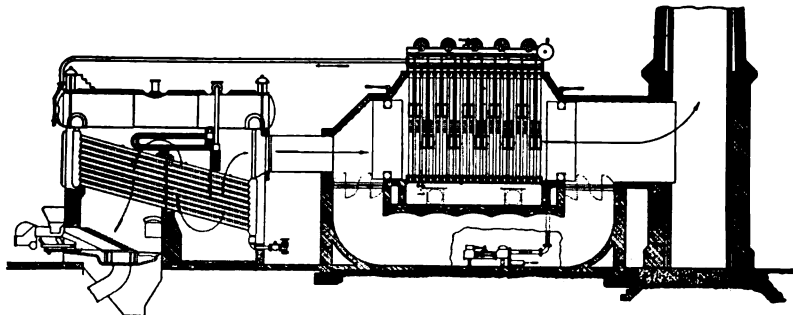
## THE GREEN FUEL ECONOMIZER CO.

90 WEST ST., NEW YORK, N. Y.

CHICAGO BOSTON PHILADELPHIA PITTSBURGH CLEVELAND ATLANTA ST. PAUL DULUTH  
ST. LOUIS SAN FRANCISCO LOS ANGELES SEATTLE SALT LAKE CITY TUCSON  
WINNIPEG MONTREAL TORONTO HONOLULU

**Builders of Green's Economizers; Green's Steel Plate Fans; High Efficiency,  
High Speed, Radial Flow Fans; Mechanical Draft Installations**

### GREEN'S ECONOMIZER



Typical Installation of Green's Economizer

64

Green's Fuel Economizer is the counter-current or multi-stage principle applied to steam generation. The boiler is required for absorbing from the gases of combustion the heat required for vaporization and to provide for the separation of the steam from the water, but the boiler surface should not extend beyond the point where the heat absorbed per square foot is worth less than the annual charges and upkeep upon that square foot. To extend the boiler surface beyond this point is wasteful, since it will not repay fixed charges, and if an economizer is used the boiler can to advantage be terminated before this point.

The Economizer, however, absorbs heat economically from flue gases at temperatures down to 300° F., primarily because it contains water at a temperature lower than that of the boiler contents, giving a greater "temperature head" than in the case of the boiler surface, also because it costs less, square foot for square foot, and is subject to a lower annual percentage for upkeep and depreciation than is the boiler surface.

As ordinarily installed, the Economizer reduces the flue gas temperatures from 600° F. to 300° F., saving 1% of fuel for each 20° reduction in the flue gas temperature. The Economizer pays from 40% to 100% interest upon the investment annually, depending upon operating conditions.

The following is a rough rule for determining the size: Allow about 5 sq. ft. of economizer heating surface per rated boiler H. P.

- 9' Tube has 12.75 sq. ft. Heating Surface.
- 10' Tube has 13.96 sq. ft. Heating Surface.
- 11' Tube has 15.17 sq. ft. Heating Surface.
- 12' Tube has 16.38 sq. ft. Heating Surface.



*For further details and information consult nearest office.*



# **MONONGAHELA TUBE CO.**

**PITTSBURGH, PA.**

**Manufacturers of Iron and Steel Boiler Tubes, Oil Well Tubing and Casing,  
Line Pipe, Etc.**

---

## **KNOBBLED CHARCOAL IRON BOILER TUBES**

### **SOFT STEEL BOILER TUBES**

**Made to American Society of Mechanical Engineers Specifications**

All sizes from 1½" to 6" diameter both inclusive.

Particular attention is called to a very important change in the meaning of the thickness of gauge as called for in the boiler tube specifications of The American Society of Mechanical Engineers. The trade custom heretofore in vogue has been that the gauge of the tube meant its average thickness, with an allowance of a variation of one gauge above or one gauge below the one specified. The A. S. M. E. specification, however, states that hereafter all tubes intended for boilers that are to be built according to the A. S. M. E. Boiler Code *must not be less in their thinnest portion than the gauge specified.*

For tubes for locomotives, the old specifications of the Master Mechanics and the American Society for Testing Materials are still in force. It is therefore necessary, when ordering boiler tubes, that the customer state whether they are intended for stationary boilers according to the A. S. M. E. specifications, or whether they are intended for locomotive boilers and their respective specifications.

65

Tube List No. 6, dated February, 1916, sent on request.

## **GENUINE WROUGHT IRON LINE PIPE**

### **OIL WELL TUBING AND CASING**

All Monongahela Pipe and Tubes are manufactured from highest quality material and by the Lap Weld process only under most improved methods.

We carry large stocks for quick shipments.

We make all sizes of Line Pipe 1½" to 6" both inclusive, Oil Well Tubing 1½" to 4" both inclusive and casing 3¼" to 8¼" both inclusive.

Price on Wrought Line Iron Pipe, Oil Well Tubing and Casing sent on request.

**Also Sole Manufacturers of**

**"ARMCO (AMERICAN INGOT) IRON**

**BOILER TUBES, LAP WELD PIPE AND MERCHANT CASING**

In "Armco" goods we make all sizes of Boiler Tubes and Pipe 1½" to 6" both inclusive, and Merchant Casing all sizes 2¾" to 8¼" both inclusive.

List of "Armco" American Ingot Iron Boiler Tubes, Pipe and Casing, can be had on request.

*"Armco" Iron Resists Rust.*

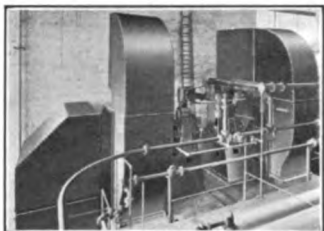
## B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASS.

Offices in all Principal Cities

**Mechanical Draft, Fuel Economizers, Steam Turbines, Steam Engines, Gasolene Engines, Gasolene Engine Generating Sets, Motors, Generators, Steam Traps, Heating and Ventilating Systems, Fans, Blowers, Exhausters, Etc.**

### MECHANICAL DRAFT



Draft produced by a fan is called mechanical draft, and may be forced or induced as conditions demand. Its cost is from 20 to 40 per cent of that of a chimney. Its intensity permits of the burning of finely divided or low grade fuel. It makes possible the utilization of the flue gases which a chimney wastes in producing draft, it is independent of the weather, decreases smoke, increases the capacity of an existing plant, and serves as an auxiliary to a chimney already overburdened. It saves space and is portable.

### FUEL ECONOMIZERS

The Sturtevant Economizer effects:

A saving of 5 to 15 per cent in fuel.

An increase of 10 to 25 per cent in boiler capacity.

An appreciable extension of the life of a boiler.

A purification of the feed water.

A reduction in expense of repairs.

The deposit of large amounts of soot.

In the Sturtevant Economizer the pipes are arranged "staggered" instead of in straight rows, thereby giving the pipes a better opportunity to absorb heat from the gases. These economizers are made with taper metal-to-metal joints that require no packing, cement or rusting. The placing of the pipes of one row opposite the spaces of the adjacent sections increases the effective area of the transmitting surfaces and thoroughly breaks up the currents of hot gases by directing them between the pipes and against those standing in their paths.

### STEAM TURBINES

The Sturtevant Steam Turbine is of the multi-velocity type, and its operation is such as to give high efficiency, and permit of moderate rotative speeds without gears. Hand valves are used for shutting off the nozzles, and the speed is regulated by a centrifugal throttling governor placed on the end of the shaft.

Internal lubrication is unnecessary, therefore the exhaust steam is free from oil.

5 regular sizes from 5 to 250 H. P.

Approximate speed from 4000 to 1000 R. P. M.

### STEAM ENGINES

(Automatic High Speed)

Vertical Single Cylinder from 1 to 150 H. P.

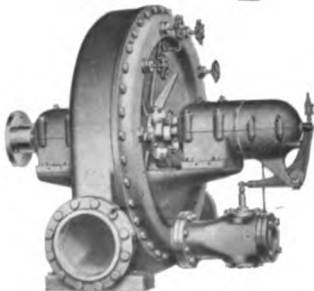
Horizontal Center Crank Engine from 25 to 225 H. P.

Sturtevant Engines are adapted to continuous operation for long periods without attention. Gravity lubrication and complete enclosure of moving parts insure cleanliness and high mechanical efficiency. Rites Governor gives  $1\frac{1}{2}$  per cent speed regulation on automatic engines.

### MOTORS, GENERATORS AND GENERATOR SETS

Direct Current Apparatus for any Standard Voltage

Bi-Pole Motors (enclosed and semi-enclosed type).....	$\frac{1}{4}$ to	3 H. P.
Four-Pole Motors.....	2 to	30 H. P.
Eight-Pole Motors.....	1 to	225 H. P.
Six-Pole Generators.....	5 to	$17\frac{1}{2}$ K. W.
Eight-Pole Generators.....	20 to	150 K. W.
Turbine Generating Sets.....	3 to	50 K. W.
Steam-Engine Generating Sets.....	5 to	150 K. W.



## B. F. STURTEVANT COMPANY

### STEAM TRAPS

Sturtevant steam traps made for different pressure, are designed for steam heaters or radiators of any construction. Both extension and cone are of brass ground to a fit. The pot is readily removed for cleaning by loosening the bolts.

### PROPELLER FANS

Propeller fans are designed for use against low pressures, and are applicable for ventilation and exhaust work in boiler and engine rooms, kitchens, clubrooms, smoking rooms, offices, stores and similar places. They are constructed with a frame of cast iron that is fastened into the wall of the building and are driven by either belt or direct-connected electric motors. The construction of these propeller fans is exceptionally strong and durable. Propeller fans are made in sizes of from 18 to 120 inches in diameter.



### MULTIVANE FANS

Multivane blowers and exhausters driven by direct-connected Sturtevant motors, turbines, and engines form the most satisfactory and efficient fan sets on the market. The blast wheel or runner for this fan is composed of shallow floats, which permit the use of very large inlets while maintaining the necessary blade area. The large inlet allows the air to enter with the least loss in friction.



Each blade or float is spooned to distribute equally the pressure within the casing and to add rigidity and strength to the wheel.

### STEEL PLATE FANS

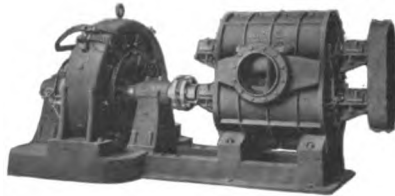
Sturtevant steel plate fans are designed for all classes of blower and exhaustor work. They are the result of fifty years' experience in blower design, are especially strong and durable and are suitable for direct-connected steam engine and electric motor drive and for belt drive. Steel plate fans are built for ventilation and mechanical draft installations, and for planing mill and other exhaustor work.

### BLOWERS AND EXHAUSTERS

Positive Pressure Blowers are designed to deliver air at pressures up to five pounds. They are especially adapted to furnishing blast for cupolas, gas and oil burners, annealing and smelting furnaces, cement kilns, and for all sorts of blower or exhaustor work demanding high pressures. Special stuffing-boxes to prevent leakage are furnished when these blowers are used to handle gases.

The Sturtevant Positive Pressure Blower is made in two types; in the smaller sizes the idler is directly above the impeller, and the shafts lie in a vertical plane. In the larger sizes, the shafts are in a horizontal plane, the intake and discharge being at the bottom and top.

The B. F. Sturtevant Company makes complete installations, including direct-connected, belted, or geared engine or motor, exhaustor, automatic regulator, blast gates, by-pass connections, and valves.



### STURTEVANT HEATERS

The Sturtevant fan system of heating and ventilating is economical and positive, heated air providing ventilation as well as heat. Indirect hot blast coils are built of one inch extra heavy steel pipe screwed into cast iron sectional heater bases. Entire heater is enclosed in steel plate casing. Heater is applicable to use of either live or exhaust steam or hot water. System can be used for heating and ventilating any kind of building. The operation is independent of the weather or of atmospheric conditions. By the use of the Sturtevant air washer, the air may be washed at all times, and cooled in summer. Hot air from the heater is forced by a fan through ducts into the building to be heated, and is allowed to escape through vent flues. Fans are driven by steam engine, motor or belt. The steam engine exhaust is used in the heater, thus obtaining heat at practically no expense. Temperature of air entering each room may be closely regulated by thermostatic control.



## **GLASGOW IRON COMPANY**

**POTTSTOWN, PENNA.**

**PHILADELPHIA**  
603 Harrison Bldg.  
15th & Market Sts.

**NEW YORK**  
D. F. COONEY & Co.  
88 Washington St.

**BOSTON**  
HARRINGTON, ROBINSON & Co.  
Sargent Bldg.

**Manufacturers of All Grades of Iron and Steel Plates**

**FLANGED and DISHED BOILER HEADS.**

**Flanged Manholes—Handholes and Flueholes.**

**ROE STAMPED STEEL MANHEAD and YOKE.**

**Standard and Heavy Threaded Pipe Flanges.**

**Companion Flanges—Off-Center Pipe Flanges.**

**MANHOLE SADDLES.**

**BUCKLED PLATES.**

**ROE BOILER LUGS.**

**Rectangular Flanged Heads.**

**WELDING AND CUTTING with the OXY-ACETYLENE  
TORCH.**



68

Many shapes formerly made in expensive Bronze Castings can now be made from Steel Plate by Press Work in combination with AUTOGENOUS WELDING.

**Pressed Steel HOT BLAST VALVES and VALVE SEATS, Patented.**

**BOSH COOLING PLATES—TUYERE COOLERS.**

**FORMING, CUTTING OUT, PUNCHING and BENDING Plate to order.**

**Bending and Forming ANGLES and SHAPES.**

**The GLASGOW FLAT FLANGES for Riveted Pipe.**

**Pressed from Steel Plate—For Any Service.**



Made **PLAIN** or  
**BORED, FACED,**  
**HUB BEVELLED,**  
**DRILLED,** to order.  
Any thickness of plate.  
6 ins. to 72 ins. **INSIDE**  
**DIAMETER.**

**These FLANGES, made with wide flanges, make Excellent Expansion Joints for Pipe Lines.**

*Correspondence Solicited.*

# LUKENS IRON & STEEL COMPANY

COATESVILLE, PA.

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Commercial Trust Bldg.

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1300 N. Branch St.

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Citizens Nat. Bank Bldg.

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Monadnock Bldg.

Cable Address: Lukens, Coatesville, Pa.

Codes—A B C—5th Edition, Western Union

## LUKENS

### FIRST TO MAKE BOILER PLATES IN AMERICA

One Hundred Years' Experience

*The Leader for Boilers and Fireboxes of All Types.*

*All our plates leveled by special straightening rolls.*

## STEEL PLATES

### THE LARGEST MILL IN THE WORLD

*We are building a 204" Plate Mill which will be running late in 1917.*

*We will be able to furnish plates 190" wide.*

Siemens-Martin O. H., Basic or Acid Steel.

Tank, Boiler, Ordinary Firebox, Locomotive Firebox and Special Specification Steel.

## UNIVERSAL PLATES

8" wide up to 48" wide, inclusive,  $\frac{1}{4}$ " thick and heavier.

## FLANGING

Machine-Flanged Boiler Heads, Flanged and Dished Boiler Heads, Flue Holes of any diameter.

We can furnish irregular flanged heads or would be glad to quote on any special flanging as we are especially equipped to take care of same.

## "BEST YET" MANHOLE FITTINGS

Our New Patented Manhole Cover Plate has no through riveted bolts. Meets all requirements of Steamboat Inspection Rules.

## HUSTON PATENT BOILER BRACE

Superior in quality, strength, lightness in weight, workmanship, general appearance and finish.

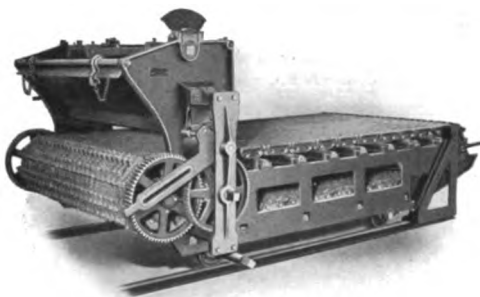
Send us your inquiries, stating just what you want, and get immediate replies.

# GREEN ENGINEERING COMPANY

SHOPS AND MAIN OFFICE: EAST CHICAGO, IND.

Manufacturers of Green Chain Grate Stokers; Geco Flat Ventilated Arches; Geco Pressure Waterbacks; Geco Ratchet Ash Drags; Geco Steam Jet Ash-Handling Systems

## GREEN CHAIN GRATE STOKERS



"K" Type for Free-burning Coals

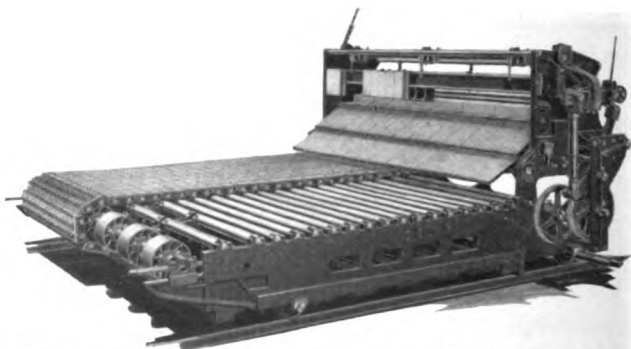
GREEN CHAIN GRATE STOKERS are designed to produce best results under the conditions peculiar to each installation. Each furnace is given special analysis so that setting best adapted to conditions and requirements is provided.

GREEN CHAIN GRATE STOKERS are designed with all frames and supporting parts away from deteriorating effect of heavy firing, thus allowing, at any time after years of service, replacements at relatively slight cost to obtain the same high efficiency and capacity as with new stokers.

GREEN CHAIN GRATE STOKERS are built in any width from 3 to 14 ft. and in length from 9 to 13 ft. deep. Driving mechanism consists of ratchet cast steel pawls and cast steel spur gear train babbitted in a self-contained frame independent of, but bolted to, the front side frame.

GREEN CHAIN GRATE STOKERS have a feed gate and driving mechanism arranged to permit instantaneous adjustment to meet varying conditions. All parts are ruggedly constructed, well protected, and readily accessible.

"L" Type  
for  
Coking  
Coals



GREEN CHAIN GRATE STOKERS "L" Type provide means for treating coking coals when introduced into the furnace to force their proper ignition and prepare them for complete combustion thereafter. Operation is entirely automatic but simple, effective and flexible through a wide range of capacity.

GREEN CHAIN GRATE STOKERS "L" Type provide the advantage of entirely automatic operation for economical combustion of coking coals with uniform and continuous high economy and high capacity found in no other mechanical stoker.

Geco Flat Ignition Arches permit the use of high ash and lignite coals and give high ignition rates with all coals.

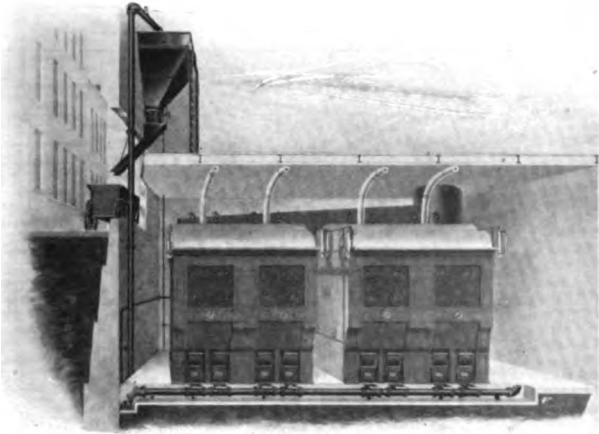
Geco Flat Ignition Arches are adaptable to any width furnace and provide uniform ignition the full width.

Geco Flat Ignition Arches are constructed so that replacements may be easily and quickly made without undue loss of boiler service.

*Three Million Horse Power in Service. Write for Bulletin No. I-A.*

# GREEN ENGINEERING COMPANY

## GECO STEAM JET ASH-HANDLING SYSTEMS



GECO STEAM JET ASH-HANDLING SYSTEMS consist of GECO Conveyor Pipe located within or in front of ash pits. Inlet openings are provided at each ash pit into which ashes may readily be drawn.

GECO Conveyor Pipe may be connected at any angle, elevation or level between the receiving intakes and the point of discharge, making the system adaptable to any building construction and allowing location of storage where most convenient for disposal to wagons or cars.

GECO Conveyor Pipe has ground joints, requiring no gaskets. Suction is produced by Steam Jets which are placed in elbows where angles in the pipe line occur. Dust, obnoxious gases and fire hazard, the three annoyances heretofore resulting from handling ashes, are all eliminated. Dust and gases are drawn in by the suction at the intakes, and no fire hazard exists as water is sprayed into the conveyor pipe, thoroughly and automatically quenching the ashes during transit and before being discharged to storage.

GECO STEAM JET SYSTEMS are reliable and simple to operate, requiring only the turning of a steam and a water valve. Ashes drawn to the intakes are instantly conveyed and discharged either in a storage tank, directly into cars, or to ash pile. Storage tank may be either wood, concrete or steel construction.

GECO Metal used in this conveyor is extremely hard and wear-resisting, insuring long life and low maintenance. Provision is made for readily replacing at small cost parts subject to the greatest wear without otherwise disturbing the system.

GECO STEAM JET SYSTEMS contain no machinery or moving parts. Their simplicity insures cleanliness, reliability and maximum capacity with minimum power, minimum labor and absolute safety to both workmen and property. No adequate comparison can be made with other methods of handling ashes.

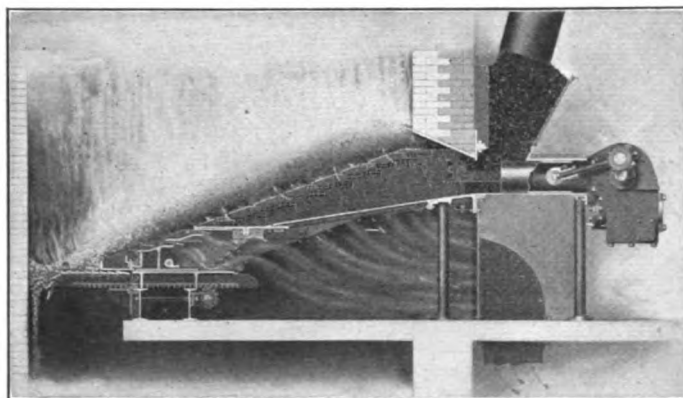
*Write for Bulletin 2-A.*



# SANFORD RILEY STOKER CO., LTD.

WORCESTER, MASS.

Sales Inquiries direct to home office, Worcester, or branch offices of B. F. Sturtevant Company, Sales Agents. British Licensees: Erith's Engineering Co., Ltd., London. French Licensees: Erith Leroy & Cie, Paris, France



## THE RILEY SELF-DUMPING UNDERFEED STOKER

72

**Adaptability.** Applicable to any boiler either water tube or fire tube, and to heating and smelting furnaces.

**Construction.** The RILEY STOKER is made up of standardized retort units. Its unique feature is reciprocating retort sides which keep the fuel bed active, even and homogeneous. The coal feed and air supply are automatically controlled to meet load demands. The dumping of refuse is continuous and automatic. A safety connecting rod for each plunger absolutely prevents damage to stoker in case plunger is blocked.

**Flexibility.** Moving air supplying grates break up the banked fire and instantly admit the air, giving rapid combustion. RILEY STOKERS will raise a boiler from banked fire to 200% of rating in five minutes.

**Efficiency.** Extraordinarily high efficiency at all ratings is obtained due to the complete and intimate mixture of the fuel with just the right amount of air.

**Capacity.** Due to the constant movement of the fuel bed caused by the reciprocating retort sides the clinkers which ordinarily retard combustion are broken up; therefore with RILEY STOKERS the gases are not choked and active combustion results at all times. The boiler capacity which can be obtained with the RILEY STOKER depends upon the number of retorts that can be installed. With boilers fired from one end 300 and 350% of rating are obtained during peaks. In other cases where the boiler is fired by two stokers set back to back 500 and 600% of rating are possible.



A few notable installations of RILEY STOKERS:

Massachusetts Institute of Technology . . . . .	Cambridge, Mass.
Hartford Electric Light Co. . . . .	Hartford, Conn.
Remington Arms & Ammunition Co. . . . .	Bridgeport, Conn.
New York Central Railroad Co. . . . .	Port Morris, N. Y.
Buffalo General Electric Co. . . . .	Buffalo, N. Y.
Public Service Electric Co. . . . .	Newark, N. J.
Youngstown Sheet & Tube Co. . . . .	Youngstown, Ohio
Milwaukee Electric Railway & Light Co. . . . .	Milwaukee, Wis.



# DETROIT STOKER COMPANY

DETROIT, MICH.

## THE DETROIT "V" TYPE STOKER

Coal is continuously fed from the Coal Magazines to the upper end of the Grates. Each alternate Grate has a slicing motion which prevents clinker from forming on the Grates and keeps the entire fuel bed moving towards the Clinker Crusher at the bottom.

The Clinker Crushers have a continuous motion, grinding the clinkers and depositing the refuse in the Ashpit below.

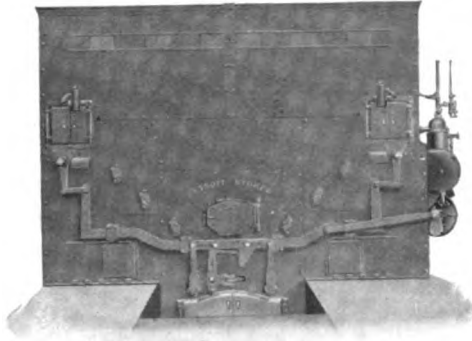
The Detroit Stoker can be equipped with either the Standard Sprung Arch or the Detrick Flat Suspended Arch. Each tile of the Flat Arch is independently suspended from the center, allowing free expansion and contraction and can be easily replaced without disturbing the Arch or brickwork.

This Arch insures high furnace and boiler efficiency and capacity as the gases of combustion are distributed evenly across the entire width of the Boiler.

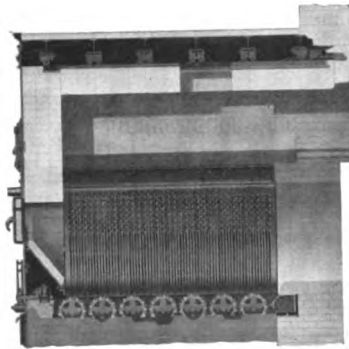
The Arches are cooled by air admitted through openings in the front of the Stoker and being preheated passes into the furnace under control, through the tuyeres over the coking coal supplying the oxygen for combustion.

Adjustments of the Stoker are easily and quickly made to meet any conditions of load or any grades of fuel.

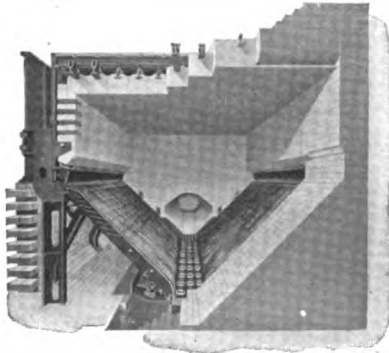
*Send for Catalogue D. Address Detroit Stoker Company, Detroit, Mich.*



Front View—Detroit "V" Type Stoker



Longitudinal View through Center of Stoker



Rear View Showing the Detrick Flat Suspended Arch

# MURPHY IRON WORKS

FOUNDED 1878

DETROIT, MICHIGAN

Manufacturers of the Murphy Automatic Smokeless Stoker

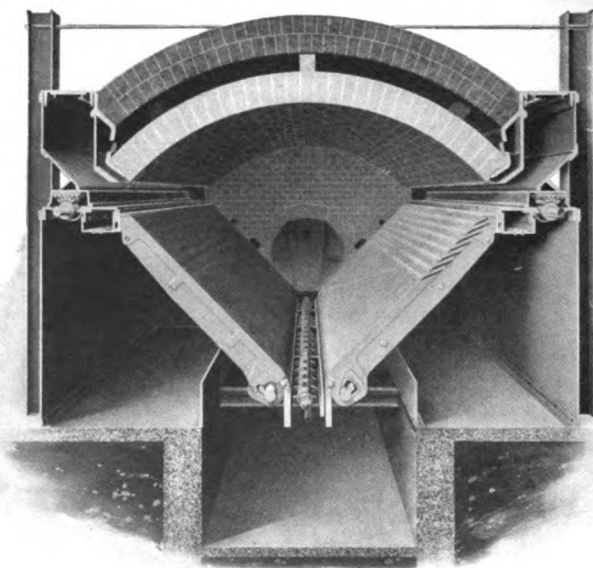
THE MURPHY AUTOMATIC STOKER is automatic in all its functions. It feeds and distributes the coal and removes the ash and refuse.

It is adaptable to any type of boiler and to units of any size.

It will handle economically all grades of bituminous fuels and is practically smokeless under normal operating conditions.

It is capable of handling variable loads and heavy overloads efficiently and with minimum attention.

The cost of maintenance is low, averaging about 10c. per horsepower per year.



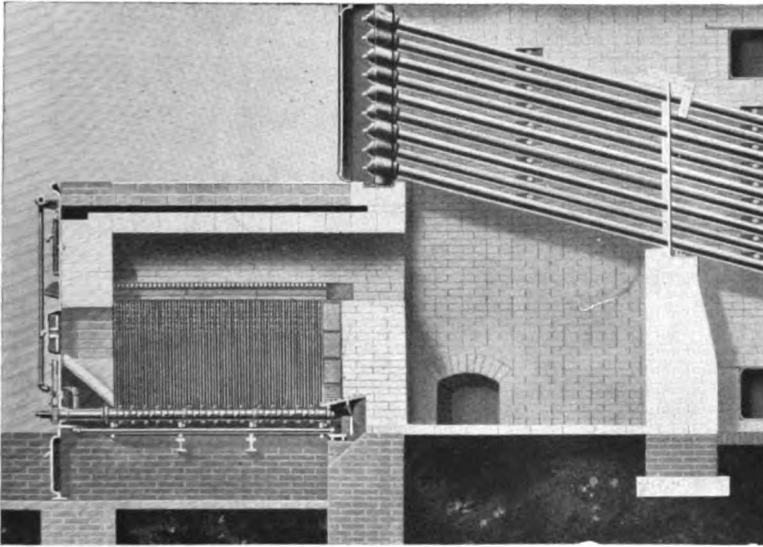
The Murphy Automatic Smokeless Stoker  
REAR VIEW

The cost of actuation approximates  $\frac{1}{4}$  to 1 per cent of total steam generated.

THE MURPHY STOKER is designed for either NATURAL OR FORCED DRAFT or for combined forced and natural draft. With natural draft the standard sizes of stokers under proper conditions will operate the boilers up to approximately 200% of their rated capacity—with forced draft to 300% of rating and over.

THE MURPHY HEAVY DUTY STOKER, for combined natural and forced draft, is an ideal equipment for central stations and plants having heavy overloads and severe peaks. This stoker combines high efficiency and low cost of actuation—obtainable under natural draft conditions—and provides for sudden demands for steam and heavy overloads quickly and efficiently.

## MURPHY IRON WORKS



**Murphy Stoker—Dutch Oven Setting**

75

At either side of the stoker extending from front to rear is the coal magazine into which the coal may be introduced either by hand or mechanically. At the bottom of this magazine is the coking plate against which the inclined grates rest at their upper ends. The stoker boxes, operated by segment gear shafts and racks, push the coal over the coking plate and on to the grates. The grates are made in pairs, one fixed and the other movable. The stationary grates at their lower ends rest on the grate bearer, which also acts as a support for the clinker grinder. The clinker grinder consists of a square steel shaft, on to which is slipped small cast iron toothed segments, which are readily replaced in case of breakage.

Just over the coking plate is the arch plate, from which a fire brick arch is sprung over the entire stoker. Upon this arch plate are cast numerous ribs to form a series of air ducts immediately over the coking plate, conveying the heated air from the chamber above the arch into the combustion chamber. This arch plate also forms the wall of the magazine. The stoker, or battery of stokers, can be operated by a small automatic engine, motor or by overhead shaft and ratchet drive, as may be desired. Arrangement is made for exhaust steam connections at the lower end of the grates for the protection of this portion of the grates and clinker grinders and for the softening of the clinker. In connection with horizontal tubular boilers or water tube boilers horizontally baffled, the Murphy stoker can be installed with a flush front setting. Arrangement can be made for extended or Dutch oven settings, should this be desired.



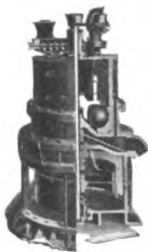
## LEHIGH CAR, WHEEL & AXLE WORKS

CATASAUQUA, PENNA., U. S. A.

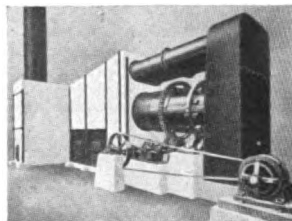
**Manufacturers of Pulverized Coal Equipment, Crushers, Dryers, Car Wheels and Axles, Castings, Etc.**



**Lehigh Crushing Rolls**



**Fuller Mill,  
Pulley Driven**



**Indirect Fired Rotary Dryer**

### PULVERIZED COAL EQUIPMENT

**Design**

**Superior in  
Efficiency**

**Performance**

We are in position to furnish all the various units used in connection with furnaces heated by means of pulverized coal. At the present time our Pulverized Coal Equipments, consisting of Lehigh Crushing Rolls, Indirect Fired Rotary Dryers, Fuller-Lehigh Pulverizer Mills, Pulverized Coal Feeders, and Fuller Quality Sprocket Wheels, are installed in plants having a capacity of 25,000 tons of pulverized coal per day. These plants are widely distributed and are pulverizing coal obtained from a large number of fields in various coal-producing districts.

The types of furnaces heated with Pulverized Coal are quite diversified, and we enumerate below some of the furnaces at present heated by means of this most economical and efficient fuel in order to convey some idea of the wide application of Pulverized Coal for heating various types of Industrial Furnaces.

Annealing Furnaces

Bar Heating Furnaces

Billet Heating Furnaces

Calcining Furnaces

Drying Furnaces

Forge Furnaces

Nodulizing Furnaces

Open Hearth Furnaces

Ore Roasting Furnaces

Piled Scrap Heating Furnaces

Puddling Furnaces

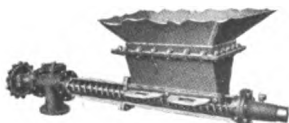
Rotary Cement Kilns

Rotary Lime Kilns

Steam Boiler Furnaces



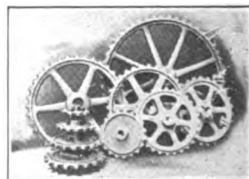
*Send for Illustrated Catalogue No. 71.*



**Pulverized Coal Feeder**



**Fuller Mill,  
Gear Driven**

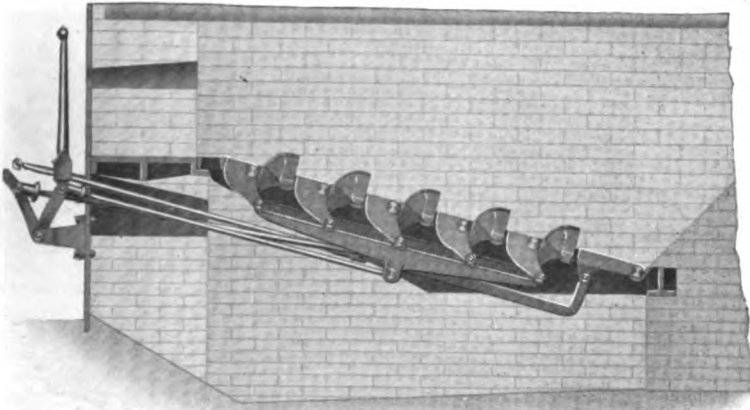


**Face Hardened Sprocket Wheels**

## HUBER HAND STOKER CO.

(Stoker manufactured by Flynn & Emrich Co., Baltimore, Md.)

PARK ROW BLDG., NEW YORK, N. Y.



77

**THE HUBER HAND STOKER** opens the field of opportunity to numerous heating and power plants, where automatic stokers would be too expensive to install or operate. Can use all grades of bituminous, or mixed coal.

This hand-operated stoker costs one-fourth that of any other stoker, but in spite of the low price will produce equal results. This stoker can be forced without danger of dark smoke, when burning volatile coal, which is contrary to that of any other stoker. It cuts and crushes the clinkers in their infancy—sifts the ash—slices the fire uniformly, and stokes the coked coal to the dump grate at the bridge wall, where the last heat units in the clinkers are consumed.

The following are the guarantees under which we install the HUBER HAND STOKER:

*Evaporate 10 lbs. of water and over per pound of Coal (14,000 B. T. U.).*

*Combined efficiency 70% and over.*

*Increase rated capacity of Boiler 50% and over.*

*Eliminate old method of cleaning fires.*

Installations can be made under any boiler within three days.

Approximately 60,000 H. P. already installed and producing satisfactory results.

### W. N. BEST SMOKELESS FURNACE

*Guarantee to increase evaporation of water per pound coal fired.*

*Guarantee to burn Bituminous coal containing up to 35% volatile coal and meet the requirements of the Board of Health in any city, which means that we burn this coal without any dark smoke.*

A device which is automatic in its control, as well as being almost fool-proof. Can be used on any type of furnace, whether on stills, boiler furnaces (vertically or horizontally baffled) or installed in connection with automatic Stokers.

Gives you the desired results at a low initial cost.

AGENTS for the W. N. Best Smoke Consuming Co.: Carl Smerling, Park Row Bldg., N. Y.

The installation of the two above devices  
will complete the efficiency of the boiler.

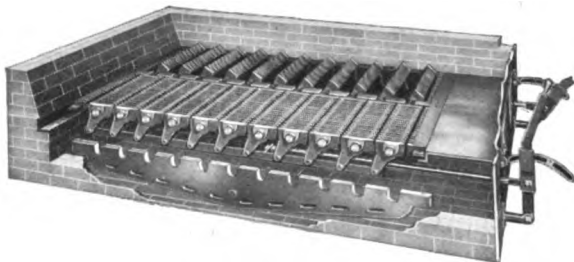
## CANTON GRATE COMPANY

1708 WOODLAND AVE., CANTON, OHIO

**Manufacturers of Canton Rocking and Dumping Grates, Canton Oil Filters, Feed Water Heaters and Other Steam Appliances**

### CANTON ROCKING AND DUMPING BOILER GRATES

These boiler furnace grates are made from select brands of pig iron which have been found to give the greatest strength and to resist heat. Their construction is such that they will not warp, as the bars are double braced.



An inspection of the cut will show the simplicity of parts, ease of installation and operation. The grates are strong and durable, and will meet the requirements of heavy mill and other steam power plant work.

#### IMPORTANT FEATURES

1. A smooth, even surface that will not warp.
2. No complicated parts, but simple in construction.
3. Easily installed in any furnace by any mechanic.
4. New bars can be put in while furnace is in operation.
5. No waste of fuel while shaking.
6. Ease with which it is operated. Lessens labor of firemen, and makes it possible to keep a uniform steam pressure.
7. Our improved safety lever which prevents all possibility of leaving the bars in an uneven position by a careless fireman. It is self-adjusting and practically fool-proof.
8. All parts made heavy and strong enough to sustain without the slightest springing many times the weight they will be called upon to bear and to resist easily any strains that can be brought upon it in the act of loosening clinkers and operating the grate under the full load of fuel.

The Canton Grates are *Efficient Steam Producers*, in most cases saving the price of the Grate in the first few months' use. Made to fit any size furnace and for any kind of coal.

### CANTON KILN GRATES

Type "B" Canton Rocking and Dumping Grate is designed to meet the special requirements of kilns for burning fire brick, red brick, paving brick, sewer pipe, drain tile, pottery, fret, etc., any place where high temperatures are required and where heat regulation is an important matter in getting the most uniform result.

They are self-supporting and can be easily changed from one furnace to another. With the self-locking mechanism they are practically fool-proof. Owing to their high efficiency they either effect a large saving of fuel, or greatly increased production with the same amount of coal.

**STANDARD SIZES:** From 18 inches to 32 inches in width and from 30 inches to 51 inches in depth. We make them any width with any depth desired.

*Complete catalog and descriptive literature gladly sent on request.*



**Type "B"**

# McCLAVE-BROOKS COMPANY

MAIN OFFICE AND WORKS, SCRANTON, PA.

NEW YORK OFFICE  
50 Church St.

CHICAGO OFFICE  
515 Hearst Bldg.

**Manufacturers of McClave's Stoker, McClave's Shaking, Cut-Off and Dumping Grates, McClave's Argand Steam Blower. All Kinds of Iron and Brass Castings**

## McCLAVE'S SHAKING, CUT-OFF AND DUMPING GRATES

Made in four different types: Nos. 1 and 2 being used principally for soft coal and the larger sizes of Anthracite; Nos. 3 and 4-A for the smaller Anthracite sizes.

**McClave Grate No. 1** is our old type of Shaking and Cut-off Grate, in which all of the grate bars are cast integral.

In our new type, **No. 2**, the regular grate bars are made with *Removable Sectional Tops*, with shanks which are mounted in sockets in the pendant body portion of the bars. Cost of repairs is thus reduced to a minimum. These grates have an absolute cut-off movement, in which each row or section can be operated as a whole, or the front and rear separately. In the shaking movement there is no increase in the openings between bars, consequently no waste of unconsumed fuel.

**McClave Grate No. 3.** Specially adapted to burn the smaller sizes of Anthracite fuel, such as Buckwheat, Birdseye, Rice, etc.

The Grate Bars are constructed with a body portion and *Removable Sectional Tops*, the shanks on the tops being arranged centrally, which makes practically a "T" formation, whereby a double cut-off movement is secured by forming pockets on either side of the bars. Each row can be operated as a whole, or the front and rear separately.

**McClave Grate No. 4-A.** This is a dumping grate, specially designed to burn the smaller sizes of Anthracite Coal. Sectional Removable Tops are made with beveled edges at end, to allow for expansion. Overlapping of edges of bars prevents sifting between the bars. Fitted with twin levers for operating the front and rear series of bars separately.

The mesh or air space in the tops is made as small as  $\frac{3}{8}$ " for the very small sizes. The construction as a whole is very strong and durable.

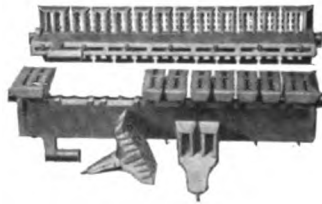
Grate frames are made in one or more rows, as required, with expansion top Journal Bearing Bars reaching from the front to rear of furnace, and having Journal Locks which fit over the journals of the Grate Bars, to prevent the bars from lifting out of their bearings when they are being operated.

## McCLAVE'S ARGAND BLOWER

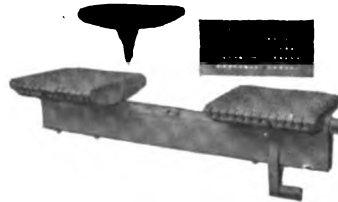
The result of over thirty years' experience with the problem of more effectually burning the cheaper grades of Anthracite and Bituminous fuels. Gives a properly proportioned combined air and steam blast, and forms a complete system when used in connection with McClave Grates. Large volume of air with small steam consumption guaranteed. Practically noiseless in operation. Automatic Blower Regulator also furnished when desired. Illustration shows new type High Duty Blower installed through side wall of boiler.



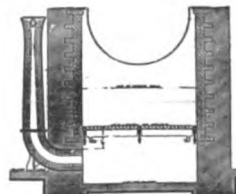
McClave Grate No. 2



McClave Grate No. 3



McClave Grate No. 4-A

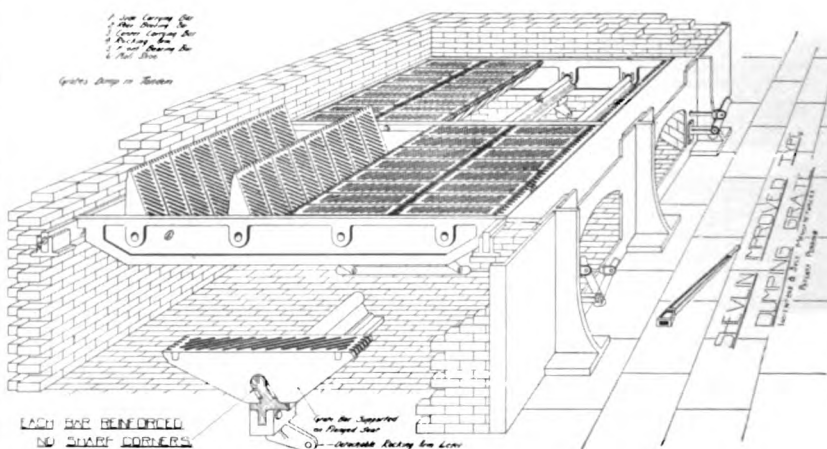


## SHEVLIN ENGINEERING CO., INC.

108 WEST 34TH ST., NEW YORK CITY

S-O Anthracite Dumping Grates  
Stationary Grates

S-O Shaking Grates  
Industrial Railways



80

### The Shevlin S-O Anthracite Self-Supporting Type Dumping Grate

is designed to burn every grade of anthracite coal. Due to the construction, its even distribution of air spreads over the entire surface, giving perfect combustion. The grates are made with any size mesh desired from  $\frac{1}{4}$  in. up. Every bar and every set of grates are fitted and operated at our foundry before shipment.

Our grate is cast to fit. There are no small parts such as caps, bolts or other fastenings sometimes used to hold grates in place.

Due to the construction of this grate which is supported on a specially designed rocking arm it takes the entire strain and weight off the slot of the grate itself. *The grate is not supported at the top of the slot, but on the four sides of the grate.* Provisions are made for expansion and contraction in the slot.

The specially designed rocker arm is oval as is also the slot in the grate, thereby eliminating sharp corners. Our method of supporting the grate does away with the sagging and warping of the bars. Other makers have tried to prevent this by means of massive frames or cradles, thereby preventing the free passage of air.

Our settings are designed to permit free passage of air through the grates, thus prolonging the life of the bars. Our setting has meshed bearing bars (front and rear) and burns fuel from edge of dead plate to face of bridge wall.

Our bars overlap and underlap each other to allow for expansion. They can be removed or put in place without disturbing any other parts. The bars are made in short sections which makes them strong and gives a serviceable setting.

There are no dead bars. The entire furnace dumps to an angle of 80 degrees. No other similar type dumps to such a degree. It is impossible to dump any grate off the rocking arm. Easy to replace, this is a practical grate for practical purposes, built for any boiler and any draft system.

All designed and patented by our Mr. John J. Shevlin, who has given twenty years to specializing in this character of work.

PATENTS PENDING.

SEND FOR OUR CATALOGUE NO. 6.



## WASHBURN & GRANGER

50 CHURCH ST., NEW YORK, N. Y.

BOSTON, MASS.

PHILADELPHIA, PA.

**Manufacturers of the Dean Dumping Grate, the Dean Shaking Grate, the Dean Furnace, Dean Fire Brick Linings, Incinerators and Destructors, Boiler Fronts and Furnace Castings, Floor Plates, Industrial Railways, Turntables**

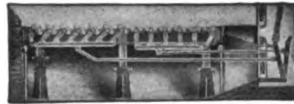
### DEAN DUMPING GRATES

Built for burning the small sizes of Anthracite coal with either natural or forced draft. Bars tip in tandem to an angle of sixty-five degrees and are supported at both ends by a rectangular frame which eliminates entirely the tendency of the bars to hang downward on the ends. Air spaces  $\frac{1}{8}$ " to  $\frac{3}{8}$ " slot and also built in the pin-hole form with  $\frac{1}{4}$ " or  $\frac{1}{8}$ " diameter openings. Fires can be cleaned in one-half the time required with stationary bars. Catalogue No. 7 on request.



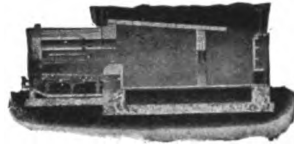
### DEAN SHAKING GRATES

Used for Bituminous and the larger sizes of Anthracite coal, both fuels requiring a grate with an oscillating or shaking movement. Supported by a frame resting on the ash-pit floor independent of the brick work with bars placed on 8" centers, allowing ample opening for the largest clinkers. Journals self-locking, requiring no caps. The sides of the bars are made solid which is a necessity as ninety percent of the wear comes along these edges. Construction is of the most durable form, to withstand hard service. Catalogue No. 7 on request.



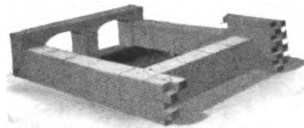
### THE DEAN FURNACE

An efficient hand-fired furnace designed for small and medium size plants and built with large refractory surfaces, has a ventilated arch to admit preheated air over the rear of the furnace and also additional air openings in the side walls of the setting. Built without the use of steam jets to eliminate smoke and provided with twin arches in the combustion chamber and Dean Shaking Grates. Complete booklet describing this furnace in detail will be sent on request.



### DEAN FIRE BRICK LININGS

Manufactured to withstand furnace temperatures of thirty-two hundred degrees from Pennsylvania flint and New Jersey plastic clays. Standard side and bridge wall blocks are made 24" long, 18" high and 8" thick with tongue and groove ends and are carried in stock for immediate shipment. The use of a block of this size eliminates the large number of joints required with standard fire brick construction and also the tendency of the furnace walls to burn out. We also build jambs and arches for all types of fire doors. Send for our catalogue No. 5 on "Refractories for Boiler Furnace Linings."



### INCINERATORS AND DESTRUCTORS

We have patterns and designs for incinerators for burning rubbish and waste material, suitable for institutions, hotels, schools, apartment houses, museums, factories, etc.

We build garbage destructors of the brick set type suitable for large hospitals and hotels and a portable type for use in large residences, clubs, restaurants, etc., designed with a steel casing and lined with fire brick to be operated with coal as fuel. Send for catalog No. 8 "Dean Incinerators."



## GWYNN GAS BURNER & ENGRG. CO.

OFFICE: 714-715 Empire Bldg.

FACTORY: 100-108 Liberty Ave.

PITTSBURGH, PA.

Manufacturers of Gas Burners, Gas Regulators and Gas Burning Equipment

### GWYNN GAS BURNERS

The following extract is from page 10 of our book "GWYNN GAS BURNERS AND PATENT COMBUSTION FURNACES," a copy of which will be gladly sent free on request:

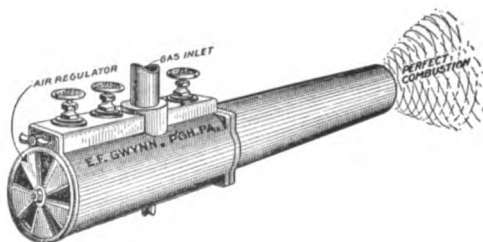
"It is very important to thoroughly mix the gas and oxygen, after they have been brought together, as the percentage of combustion obtained will depend on the manner in which they have been mixed. A perfect mixture can be obtained only by putting gas and oxygen in violent agitation before reaching the combustion chamber."

#### How the Gwynn Gas Burner does this:

The design of GWYNN GAS BURNERS is such that the gas enters the mixing chamber through the side walls of the burner, at an angle to the axis, and forming a converging cone in the center of the burner, through which air cannot pass without coming in contact with the gas. The angle at which the gas inlet holes are drilled puts a spiral or rotary motion on the column of gas and air while passing through the mixing chamber, thereby insuring a perfect mixture before reaching the point of ignition.

This rotary motion keeps the air and gas agitated and mixed until complete combustion takes place.

The GWYNN GAS BURNER is made in all sizes and applied successfully to almost every conceivable use, a few of which are mentioned below, as follows:



Open End Type of Burner

Boilers	Kettles
Kilns	Lead
	Paint
Furnaces	Varnish
Annealing	Grease
Treating	Composition
etc.	etc.
	House Heating
Ovens	Hot Air
Core	Hot Water
Baking	etc.

**We Can Furnish Air Blast Connections for Intense Heating Work**

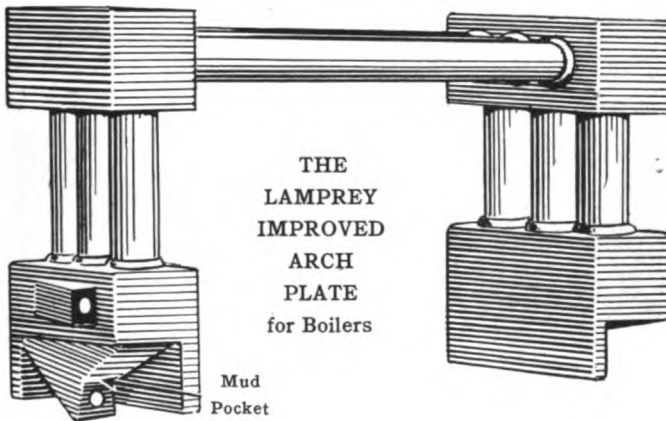
**Compressed Air Connections Furnished on Every Burner**

**GAS BURNERS** for Hot Water, Steam and Hot Air furnaces for house heating and other small heating work fully explained in Catalogue No. 20. Write for copy.

# THE LAMPREY COMPANY

WESTFIELD, MASS.

Manufacturers of the Lamprey Improved Arch Plate



The Lamprey Improved Arch Plates are a combination of *Pipes* and *Castings* systematically arranged along the sides and top of boiler mouths.

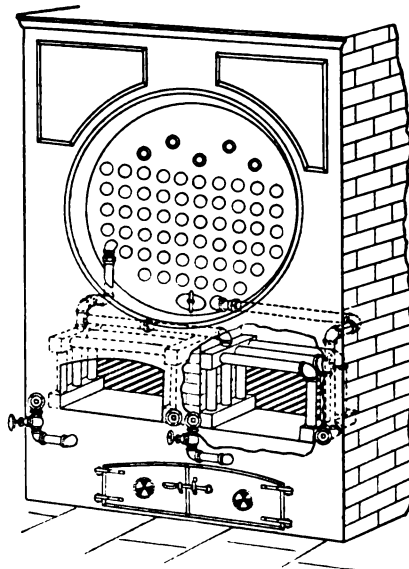
They absorb heat otherwise destructive to iron and brick arches, eliminating entirely the expense of repairing arches and cheek pieces. They prevent the burning out of door plates and the cracking of fronts, all of which troubles are very common in boilers forced to their full capacity.

Being filled with water from boiler or pumps they insure perfect circulation at all times when boiler is under fire, which prevents clogging and the subsequent dangers and risks attached to boilers in that condition.

Because of the passage of feed water through the pipes of the arch plate, the temperature of the feed water is raised usually about 75 degrees, affording a saving in fuel sometimes as high as ten percent.

**Installations Guaranteed.**

*Catalog and prices on application.*



## M. H. DETRICK CO.

549 W. WASHINGTON St., CHICAGO, ILL.

DISTRICT SALES OFFICES

Chicago Milwaukee St. Louis Detroit Cincinnati Cleveland  
New York Philadelphia Pittsburgh Boston

Manufacturers of Flat Suspended Fire-Tile Arches

### DETRICK FLAT SUSPENDED ARCHES

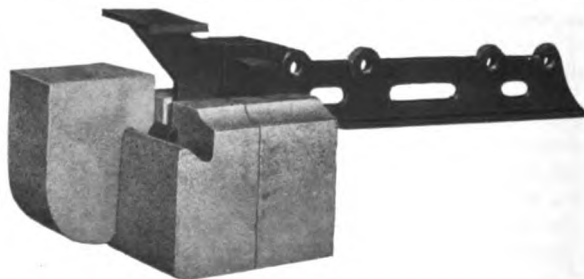
Applied to

All Types of Boilers and Stokers



Front View Showing Application of Detrick Flat Suspended Arch to Chain Grate Stoker

The freely suspended individual tiles can move under expansion stress, thereby relieving the side walls from side thrust entirely. Any tile can be replaced when necessary without disturbing the balance of the construction. The flat under surface provides a more uniform distribution of the gases and maintains a higher temperature for the burning of the mixture of air and volatile gases.



View Showing End Construction

The end construction shown in the accompanying view is a unique feature in providing the following essentials:

1. Practical apron wall support.
2. Flexible construction, allowing easy repairs.
3. Unit system of suspension.

There is a reason why over 500,000 boiler horse power are equipped with Detrick Flat Suspended Arches.

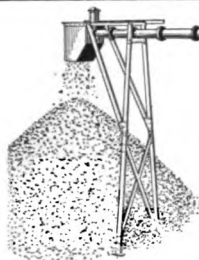
*Descriptive Literature on request.*



# AMERICAN STEAM CONVEYOR CORP'N

CHICAGO: 326 West Madison Street NEW YORK: 50 East 42nd Street

Engineering and Sales Offices in All Other Principal Cities



## The Product

### AMERICAN STEAM JET CONVEYORS

for economical handling of ashes, combustion ashes, soot, blast furnace dust, coal siftings, etc., from boiler or furnace room to any point desired. The largest line of fittings made by any company manufacturing non-mechanical ash disposal systems.

## Construction

An American Steam Jet Conveyor consists of a heavy pipe line made of very hard, new-pig cast iron and special patented fittings with removable hard metal wear parts. Pipe line is installed in the boiler house and ash intakes are located at the most convenient points. Little more space is required for the installation than for a 6-inch or 8-inch pipe line.

## Operation

One man rakes the ashes into an intake conveniently located. He turns a valve—the suction of a steam jet shoots the ashes through a pipe—100 feet up if required—100 to 300 feet away—to pit, pile, overhead hopper, car, wagon—anywhere desired. Three to ten tons of ashes are moved in an hour and the expense is just a little steam.

## Saving

It costs from 20 cents to a figure well over a dollar to handle one ton of ashes by hand. It costs from 6 to 10 cents a ton to have an American Steam Jet Conveyor shoot them anywhere you want them.

## Ease of Installation

Old and new plants, hand and stoker fired, are easily equipped with American Steam Jet Conveyors. Every condition of installation, no matter how difficult, can be met. Delivery of ashes may be made vertically, horizontally, or around corners to any point desired.

Systems are made in units 4, 6 and 8 inches in diameter. 6- and 8-inch diameters are used for ash conveyors. 6-inch and smaller sizes are used for conveying soot from economizers, breechings, combustion chambers of boilers, and coal sifting from stokers.

## Extent of Use

Over 600 American Steam Jet Ash Conveying Systems are in daily use in this country and Canada. The plants on this list represent nearly every branch of industry. All of these plants have found the logical solution of their ash handling problem in an American Steam Jet Conveyor System.

## Labor Trouble Avoided

Ash handling by hand is one of the most disagreeable jobs about a plant and it will always be difficult to get men to do this work. The use of an American Steam Jet Conveyor releases from one to four, five or six men to engage in labor more productive to their employer and themselves.

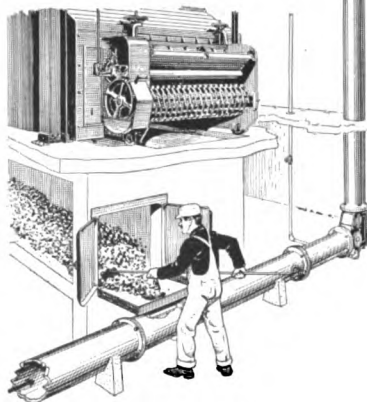
## Manufactured and Installed by Engineers

Experts in ash handling give each contract personal attention. They are in close touch with 800 successful American Steam Jet Conveyor installations. They are familiar with every conceivable phase of economical ash handling. Advice and suggestions are free, and without obligation.

Write for more information. Be sure to ask for Catalog ME.

## A New Book

"MODERN METHODS OF ASH HANDLING AND DISPOSAL," containing information of value and interest to owners, superintendents and engineers has been published in a limited edition. A free copy will be sent on request.



## DODGE SALES & ENGINEERING CO.

Distributor of the products of

DODGE MFG. CO., MISHAWAKA, IND.

15 Branch Warehouses in the United States.

Dealers in Every Representative City



### THE EUREKA WATER SOFTENER

In converting water into steam there is, under the most favorable conditions, a great waste of heat energy. To minimize this loss has been the aim of mechanical men and inventors ever since the adoption of steam as a motive power.

Practically all natural waters are impregnated, to a greater or lesser extent, with soluble metallic salts, which tenaciously attach themselves to the boiler tubes and shell as the water is evaporated into steam, thus forming a cement coating, that not only persistently resists removal, but is also a non-conductor of heat.

Scale  $\frac{1}{8}$  inch thick is very common in boilers and appears to be insignificant, yet careful experiments have demonstrated that even such a thin layer of average composition causes a loss of 9% in heating power, which rapidly increases as the layer thickens between cleanings.

Mechanical cleaners are expensive to operate, both as to power and labor required and the more inaccessible parts of the boiler are *never* reached. In many plants a force of men are continually at work drilling out tubes.

Exhaust steam feed water heaters can remove from water only the carbonates (lime), as these are held in solution by carbonic acid gas which is expelled by ordinary boiling at atmospheric pressure, and the carbonates, being thus released, are partially precipitated in the heater. The sulphates, however, which form the hardest kind of scale, are not affected in the heater, and pass on into the boiler where they are precipitated by the high temperatures attained under pressure.

Another expensive phase of the water supply problem is found in many localities where manufacturers are unable to use their own well water owing to its extreme hardness, and are forced to buy a high priced city supply, which, though better than their well water, is far from perfect. The cost of treating such waters is comparatively little, the average water running only about two cents per 1000 gallons for the necessary chemicals.

Practically all water supplies, whether from well, stream or lake, can be reduced to a common uniform degree of softness by the Dodge "Eureka" Automatic Water Softener and Purifier.

The water may be supplied to the inlet tank either by pressure or gravity. A constant head is maintained in this tank, and the weight of the water falling on a wheel, E, furnishes all the power required to actuate the plant.

A portion of this raw water is diverted to a saturator, J, where a clean lime solution of constant strength is manufactured. In our method none of the impurities in the lime come in contact with the water to be treated, thus there are no lime particles to go over into the piping and boilers. The alkalinity of the purified supply is practically nil, so there is not only no danger of foaming in the boilers, but the water is eminently suitable for all kinds of high class work, such as in wool scouring, dyeing, bleaching, etc.

A series of spiral plates, N, accelerate the precipitation of the impurities as the water travels upwards after the chemical reaction has occurred. The sludge deposited on these plates gravitates into the cone from whence it is flushed to the sewer by simply opening the valve S for a few seconds daily.

After leaving the spiral accelerators the water passes through a wood fibre filter, A, into reservoir Y, from which point it is drawn off for use, all scale-forming matter, mud, etc., having been removed.

The machine starts and stops automatically as water is required and will supply any quantity up to the rated capacity. The only attention necessary is about 20 minutes daily, which can be given by the engineer or other employee without interference with his regular duties. It is never necessary for any purpose whatsoever to enter the machine.

*Further particulars will be furnished upon application.*

## WM. B. SCAIFE & SONS CO.

Founded 1802

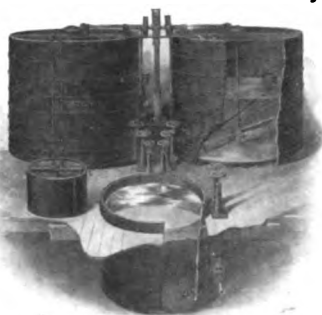
PITTSBURGH, PA.

**Water Purification for All Purposes: Continuous and Intermittent Water Softening and Purifying Systems; Pressure and Gravity Filters and Filtration Systems**

### SCAIFE WATER SOFTENING AND PURIFYING SYSTEMS

The fundamental features of all our designs of systems are—accurate chemical treatment, thorough mixture of reagents with water, accelerated chemical reaction, rapid sedimentation, and perfect clarification. Design for each installation and performance guarantees are based upon scientific investigation of water supply and uses, supplemented by analysis and treatment of water in own laboratory.

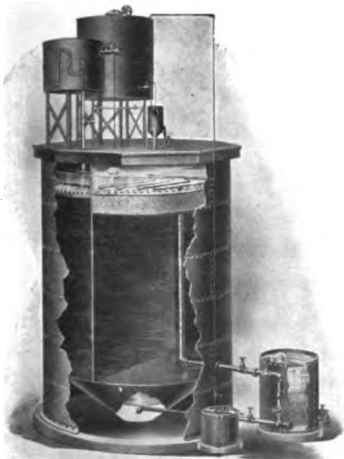
**We-Fu-Go System—(Intermittent):** In this system definite quantities of water are treated, therefore accuracy of treatment can be maintained and uniform water obtained regardless of variations in quality of raw water or rate of use. Consists essentially of two or more reaction and settling tanks, fitted with mechanical stirring devices operated by power, a small reagent mixing tank, means for introducing the reagents into the reaction tanks, and a quartz filter of either gravity or pressure type. Built for any capacity.



**We-Fu-Go System (Patented)**

**Syphon System—(Continuous):** An automatic system not dependent upon moving mechanical devices for reagent introduction. The water enters a receiving tank to which is connected a syphon, into the long leg of which smaller syphons connect from the solution tanks. Reagents introduced during the period of syphon discharge. This system can be arranged to be operated either from the ground or from the top.

In addition we manufacture three other standard continuous systems and design special systems where required.



**Syphon System (Patented)**

### PRESSURE AND GRAVITY FILTER SYSTEMS

**Pressure Filters** are adaptable for every purpose and are built in capacities from 20 gallons per hour upward, to withstand any required pressure. When operated in pairs, each filter is cleaned with filtered water, one filter furnishing the water for cleansing the other.

**Gravity Filters** are built in units with capacities varying from 8,000 to 1,000,000 gallons per 24 hours each. Combinations for practically any capacity with required sedimentation can be furnished.

Patented brass conical strainers and patented valveless coagulant feed apparatus are special features embodied in these filters and filter systems.



**Pressure Filters**

## HARRISON SAFETY BOILER WORKS

3130 N. 17TH STREET, PHILADELPHIA, PA.

**Manufacturers of Cochrane Feed Water Heaters, Steam and Oil Separators, Multiport Valves, Metering Heaters, Sorge-Cochrane Hot Process Feed Water Softeners**

### COCHRANE EQUIPMENT FOR STEAM PLANT EFFICIENCY



Horizontal Separator

For protecting engines and turbines against water, use Cochrane Steam Separators. See our book on "Cochrane Separators, Their Design, Types and Uses."

For reducing vibration and pulsation in steam lines, use Cochrane Receiver Separators, which have an ample well to receive large doses of water and to supply steam storage.



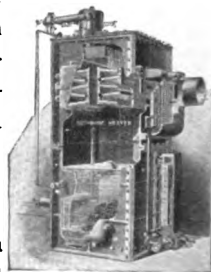
Receiver Separator

For purifying exhaust steam of cylinder oil, use Cochrane Oil Separators.



Vertical Separator

To utilize exhaust steam to heat the feed water, while providing a hot well and automatic raw water regulator, use the Cochrane Open Feed Water Heater. See our catalog on "Cochrane Heaters for the Profitable Utilization of Exhaust Steam."



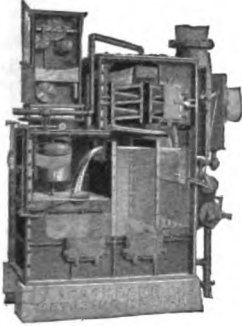
Open Heater

In connection with exhaust steam heating or drying systems, install the Cochrane Steam-Stack and Cut-Out Valve Heater and Receiver,

which is fitted with a separator large enough to purify all of the exhaust steam in the plant, and with valves by means of which the body of the heater can be cut out of circuit for inspection or cleaning while the separator continues in operation. See our "Exhaust Steam Heating Encyclopedia."



## HARRISON SAFETY BOILER WORKS

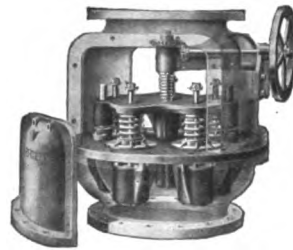


**Metering Heater**

For measuring the evaporation per pound of coal, install the Cochrane Metering Heater. It performs all the functions of the standard Cochrane Heater, and besides accurately meters the water. See our book, "Finding and Stopping Waste in Modern Boiler Plants."

For protecting the exhaust steam system against excessive rise of pressure, install the Cochrane Multiport Valve. This valve makes it possible to adjust the back pressure quickly and easily, but there is no possibility of overweighting, tying down or jamming, as by overtightening of glands. See our book on "Multiport Valves, Their Types and Uses."

For preventing vacuum backing up through the mixed flow turbine to the engine exhaust line and thereby drawing in air to the detriment of the vacuum, use the Cochrane Multiport Flow Valve, explained in the "Multiport catalog."



**Multiport Valve**



**Water Softener**

For protecting the boilers against scale and corrosion, and keeping out sludge and sediment, while at the same time securing all the advantages of heating the water to the maximum temperature, install the Sorge-Cochrane Hot Process Water Softener. See "Recent Developments in Softening Boiler Feed Water."

### COCHRANE ENGINEERING SERVICE

Our organization offers its assistance in connection with the profitable utilization of exhaust steam for heating water for boiler feed and other purposes, and for heating buildings, drying materials, operation of low pressure turbines, also for the softening and metering of water. Even if you have no present problem, you may obtain valuable suggestions from the Cochrane literature above mentioned.

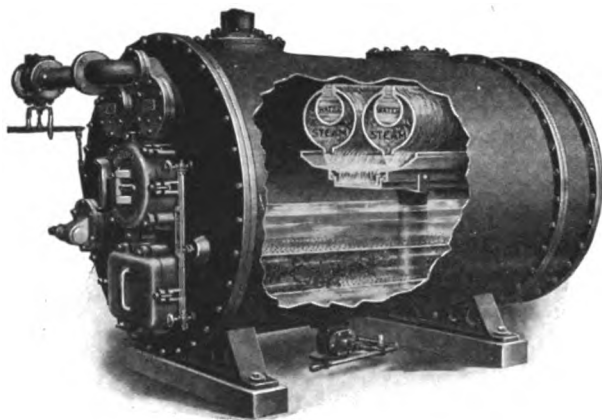
## THE NATIONAL PIPE BENDING CO.

BOSTON OFFICE  
10 High Street

MAIN OFFICE AND WORKS  
NEW HAVEN, CONN.

NEW YORK OFFICE  
149 Broadway

**Manufacturers of the National Coil or Closed Feed Water Heater. The National Direct Contact Feed Water Heater and Purifier. National Storage Heaters. National Steam and Oil Separators. Coils and Bends of Iron, Brass and Copper Pipe**



### **NATIONAL FEED WATER HEATERS**

The feed water is brought to high temperature by direct and actual contact with the exhaust steam, then freed from those impurities which are precipitated by heating, and lastly, filtered before flowing to the pump. It combines in one apparatus a Heater, Purifier, Storage Reservoir and Oil Separator.

The water enters through a regulating valve and is distributed to the smaller or inner pipes which extend the full length of the heater. Overflowing the port at the top, it passes as a thin film over the entire outer surface of the large pipe. During this time it is warmed by the steam in the steam pipe which practically surrounds the water pipe. The exhaust steam after passing through a National oil separator, which forms a part of the heater, escapes from the steam pipe through the port at the bottom and in passing through the curtains of water heats it by actual contact to the temperature of the exhaust steam.

The heated water collects in the tray beneath the pipes and by means of a vertical pipe reaches the bottom of the heater where the scale-forming substances are precipitated. The water then passes upward through the filter material to the hot storage chamber from which the pure hot water flows direct to the pump.

Upward filtration has these advantages: the filtering material needs cleaning or renewal only at long intervals because most of the solids separate out below it, relieving the filter bed of all unnecessary work; in case the perforated plates supporting the filtering material should break, the material will not be carried over to the pump, as would be the case with downward filtration.

A quick-opening blow-off valve at the bottom of the heater affords opportunity to clean the filter bed by reversing the flow.

*Described in Catalog No. 52.*

## THE NATIONAL PIPE BENDING CO.

### NATIONAL CLOSED FEED WATER HEATER

For use when the feed water need not be purified. In the National, the feed water is heated while being pumped through a coil of seamless-drawn brass or copper tubing surrounded by exhaust steam. The water is absolutely free from even a trace of oil, for it does not come in contact with the exhaust steam. The brass or copper has no effect on the water.

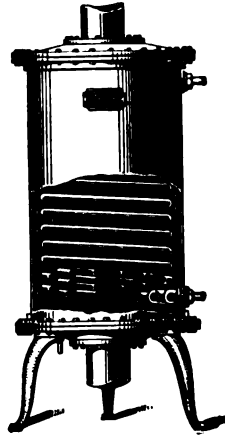
The enclosing shell is of cast iron or steel plate; it lasts indefinitely because the feed water cannot reach it.

The economy resulting from the utilization of exhaust steam varies from 8 to 13 per cent of the coal burned, depending on conditions—temperature of feed water and boiler pressure; but other advantages are reduction of strains caused by feeding cold water, and increase in boiler capacity.

The National is safe—the coils are tested to 600 pounds water pressure, and the shell is subjected to exhaust pressure only.

More than 3,250,000 horse power of these heaters have been installed.

*Described in Catalog No. 51.*



91

### THE NATIONAL OIL SEPARATOR



Patent applied for

This gravity-type oil separator absolutely removes all grease or cylinder oil from exhaust steam so that the condensation may be used for feeding boilers, in laundry or dye-house service, ice making, or for similar purposes. It has a multi-ported baffle plate, each port having an individual baffle, a distinctive feature found only in the National Separator. The large capacity of this separator not only insures effective separation of oil from exhaust steam but also overcomes the pulsations of exhaust, giving an even flow of steam.



# WARREN WEBSTER & COMPANY

Established 1888 Incorporated 1895

MAIN OFFICE AND WORKS, CAMDEN, N. J.

## BRANCH OFFICES IN

NEW YORK	PHILADELPHIA	CHICAGO	BOSTON
PITTSBURGH	ATLANTA	ST. LOUIS	CINCINNATI
INDIANAPOLIS	CLEVELAND	MINNEAPOLIS	KANSAS CITY
HOUSTON	NEW ORLEANS	SEATTLE	SAN FRANCISCO
LOS ANGELES	DENVER	WILKES-BARRE	WASHINGTON, D. C.
SAGINAW	DETROIT	SALT LAKE CITY	EL PASO
RICHMOND	MILWAUKEE	ROCHESTER	CHARLOTTE
Sole Representatives and Manufacturers for Canada			
DARLING BROTHERS, LTD., MONTREAL			
St. Johns,	Winnipeg,	Calgary,	Toronto,
			Vancouver,
THE ATMOSPHERIC STEAM HEATING CO., LTD., LONDON, ENG.			
LONDON, ONT.			

## WEBSTER SYSTEMS OF STEAM HEATING

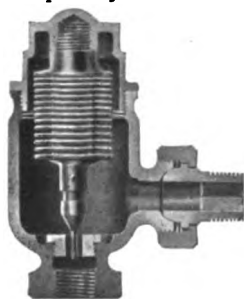
### Vacuum

### Hy-Lo

### Modulation

Having been pioneers in Vacuum Heating and before the engineering world for 29 years there are few in the line who do not know the reputation we have established for excellence of materials and service.

The devices which go to make up a Webster Vacuum or Modulation System are varied in construction and operation so as to meet all requirements, and standing back of each Webster Installation as we do, it is but natural that we prefer to co-operate with the Architect, Engineer or Contractor in the design and construction of the apparatus. The Webster Appliances are furnished as a complete system.



Webster Sylphon Trap  
No. 522—Interior View

Although the Webster Sylphon Trap is by far the best water and air relief trap on the market we find many cases where other traps of our manufacture are better adapted to specific cases, so for this reason we would advise those who specify systems of this type to leave the selection of the devices to us, where we are called upon to guarantee results.

The Webster Modulation Valve is made in several types also and can be applied to the supply connection of any kind of radiating surface using steam as a heating medium.

Universal joint—Extended stem valves for radiators beneath seats

or behind grills, chain control for overhead radiators or coils have been perfected to a point of absolute success.

The several types of Webster Modulation Valves are used successfully with or without a vacuum pump according to the nature of the building or buildings in which they are installed, and where applied and operated according to our instructions make it possible to modulate the temperature of a room by measuring the quantity of steam admitted.

The removal of air and water of condensation from radiators, coils or piping is accomplished successfully without steam leakage. The Webster Sylphon Trap, the most efficient device for that purpose, operates at any pressure or vacuum from 15 pounds above to 15 inches below, atmospheric pressure being compensated for pressure.

A perfect balance within this System can be maintained by the application of our Hy-Lo method with which a high vacuum can be carried on trunk lines and lower vacuums on branches, making lifts and difficult situations easy to overcome.

For Convenience and Economy in heating, there is no better method than "The Webster" and with our trained engineering corps, backed by our ability to make good, the slogan that "The Webster Guarantee is the Owner's Insurance Policy" is a fact and not a theory.

Catalogue V-34 sent upon request.



Webster Modulation Valve  
Type N—Interior View

## WARREN WEBSTER & COMPANY

### WEBSTER FEED WATER HEATERS

The Webster Chemical Purifier is a Feed Water Heater and Purifier of the Hot Process Type using simple and cheap chemicals for the thorough purification of hard scale forming boiler feed waters.

All Webster Feed Water Heaters embody the following special features:

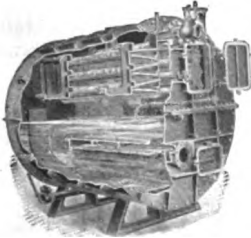
(a) Heating Trays of perforated sheet metal, light, easy to clean, durable and permitting the most intimate intermixture of steam and water because of the small perforations obtainable by the use of such materials.

(b) Open Sink Pans (instead of hollow floats)—for automatically controlling water inlets and overflow—positive in action, cannot become inoperative except by abuse.

(c) Complete segregation of oil separator drips from any connection with other openings into the Heater, thus preventing oil contamination otherwise caused by accident or negligence.

(d) Vacuum Principal, by which the Heater assists the passage of steam into itself, thereby reducing back pressure upon engines.

Webster Heaters save (1) Fuel (usually from 10 to 17%), (2) Water (usually from 10 to 14%) as compared with the use of a closed type of heater or with no heater whatever, (3) Boiler repairs due to boiler strains, and (4) Boiler cleaning expense due to their action as Water Purifiers.



Webster Feed Water Heater  
Class ED Standard Type  
Interior View

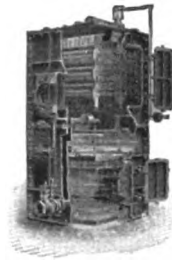
Oil Separator of ample size to purify all steam passing through the exhaust main to both the Feed Water Heater and to a Heating or Drying System or to Low Pressure Turbines).

Class "EB"—300 to 12000 horsepower capacities—vertical rectangular pattern—upward flow filtration.

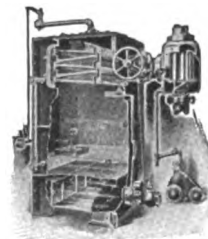
Class "EC"—500 to 7000 horsepower capacities—vertical rectangular pattern—upward flow filtration.

Class "ED"—500 to 15000 horsepower capacities—horizontal cylindrical pattern (particularly adapted for low head-room)—upward flow filtration.

Class "EF"—50 to 350 horsepower capacities—vented rectangular one-piece body type—either upward or downward flow filtration as required.



Webster Feed Water Heater  
Class EC Standard Type  
Interior View



Webster Feed Water Heater  
Class EB Cut-Out Type  
Interior View

Catalogue F-34 sent upon request.

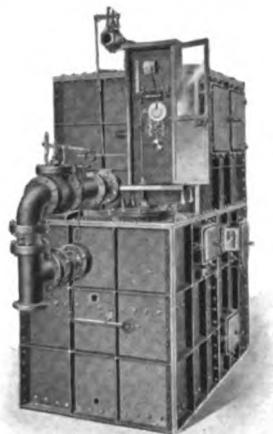
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(Continued from preceding pages)

## WARREN WEBSTER & COMPANY

### WEBSTER-LEA HEATER-METER

A practical combination of a thoroughly efficient Feed Water Heater with an accurate V-Notch Weir Meter so arranged that either unit may be operated with equal efficiency, in combination or independently. Has all the advantages of independent apparatus, as there is no interior connection between the heating chamber and the measuring tank. All floor space and head-room requirements are reduced to a minimum. Division plate between Heater and Meter prevents direct flow of heated water to Meter. Water passes through outside connection which contains a regulating valve operated by a float that is located in the storage chamber for heated and metered water. Flexibility is insured, as either unit may be cut out of service while the other remains in efficient operation. The Patented Extra Storage Type Meter has a large storage chamber for heated and metered water.



**Webster-Lea Heater-Meter**  
Patented and Patents Pending

Absolute meter accuracy results because

1. The Weir cannot be flooded, even if the Heater were to overflow.
2. Variations in steam pressure in Heater cannot affect water levels in the Meter. Made in the following types, of cast iron, wrought iron, steel or special materials:
  - (a) For exhaust pressure ranging from atmospheric to one pound.
  - (b) Equipped with cut-out valve and Preference Oil Separator, for use in connection with any type of heating system, under normal back pressures.
  - (c) Made to withstand abnormal back pressures up to twenty pounds per square inch.

Fully covered by patents granted and pending.

*Catalogue L-34 sent upon request.*



**Webster Oil Separator**  
Interior View

### WEBSTER STEAM AND OIL SEPARATORS

Webster Steam Separators for the protection and added economy of engines, turbines and pumps, and Webster Receiver Separators giving in addition a means for permitting smaller piping and for equalizing pulsations, are manufactured in types for any direction of flow (horizontal, vertical or angle), of either cast iron or cast steel, and for high or low pressure.

Webster Oil Separators for either pressure, atmospheric or vacuum conditions and Webster Receiver Oil Separators for use with low pressure turbines or other service are made for horizontal, vertical or angular direction of flow and of several types depending upon operating conditions. Exhaust steam which has passed through any type of Webster Oil Separator may, when condensed, be returned to boilers or used for manufacturing purposes with perfect safety.

*Catalogue S-34 sent upon request.*



**Webster Steam Separator**

# MILWAUKEE RELIANCE BOILER WKS.

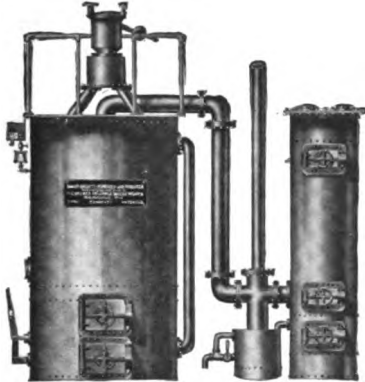
MILWAUKEE, WIS.

Manufacturers of Gas Producers, Feed Water Heaters, Storage Tanks

## SHARP-BASSETT IMPROVED GAS PRODUCER

Designed to operate on anthracite coal.  
Multiple unit plants in any size

Built in units of 25 to 300 H. P.  
Complete power plant installations



Sharp-Bassett Improved Gas Producer

In designing the SHARP-BASSETT IMPROVED GAS PRODUCER, it has been our aim to place a gas producer on the market that is simple, convenient to operate, economical and absolutely reliable under all working conditions.

The producer is entirely self-contained, depending in no way on a separate source for the generating of steam or heating of the in-going air supply. It is complete and ready to be connected to a gas engine or to heat-treating furnaces as may be required.

Our Improved Producer is a gas generator, a steam generator, a heater and a saturator all in one. The heating and the saturating of the air is accomplished by means of utilizing the heat which radiates from the fuel column through the lining and shell. This greatly increases the efficiency of our Producer which with nearly all other makes of producers is a total loss.

## BOILER FEED WATER HEATERS AND PURIFIERS

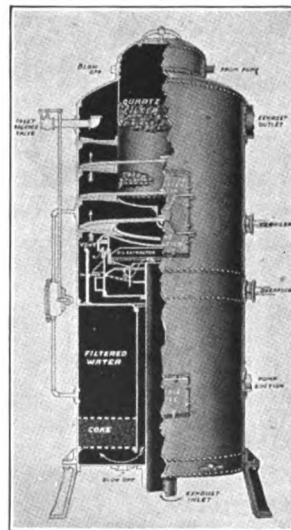
Our heaters are built throughout in the most substantial and workmanlike manner. They have a large heating surface and are very accessible, making it very simple to get into the interior for cleaning or removing any parts.

The Perfection Boiler Feed Water Heater and Purifier is built in two types. The double filter type shown is a combination open and closed heater with two filters. The single filter type is an open heater with an oil extractor enclosed entirely inside of the heater. This is flushed out every time the heater overflows, and thus kept perfectly clean. The double filter heater has all the same features of the single filter heater with the addition of a boiler pressure filter which is placed in the top of same.

The Reliance Heater and Purifier has an oil extractor placed on the outside of same. This oil extractor has a hollow baffle through which all the water passes before entering the heater.

All heaters manufactured by this company have the under-feed filters; that is, the water passes to the bottom of the heater and then up through the filter-bed.

The Reliance Closed Heater is made of heavy plate steel. It is constructed with both heads removable so as to make the tube ends easily accessible either for the purpose of cleaning or renewing tubes. Can be made with copper, brass, steel or iron tubes.



Perfection Heater and Purifier

## WESTINGHOUSE ELECTRIC & MFG. CO. EAST PITTSBURGH, PA.

Atlanta, Ga.  
Baltimore, Md.  
Birmingham, Ala.  
Bluefield, W. Va.  
Boston, Mass.  
Buffalo, N. Y.  
Butte, Mont.  
Charleston, W. Va.  
Charlotte, N. C.  
Chattanooga, Tenn.  
Chicago, Ill.  
Cincinnati, Ohio

Cleveland, Ohio  
Columbus, Ohio  
\*Dallas, Tex.  
Dayton, Ohio  
Denver, Colo.  
Des Moines, Ia.  
Detroit, Mich.  
Duluth, Minn.  
\*El Paso, Tex.  
Indianapolis, Ind.  
Joplin, Mo.  
Kansas City, Mo.

Louisville, Ky.  
Los Angeles, Cal.  
Memphis, Tenn.  
Milwaukee, Wis.  
Minneapolis, Minn.  
New Orleans, La.  
New York, N. Y.  
Philadelphia, Pa.  
Pittsburgh, Pa.  
Portland, Ore.  
Rochester, N. Y.  
St. Louis, Mo.

Salt Lake City,  
Utah  
San Francisco,  
Cal.  
Seattle, Wash.  
Syracuse, N. Y.  
Toledo, Ohio  
Washington, D. C.  
Wilkes-Barre, Pa.  
\*W. E. & M. Co.  
of Texas

### ELECTRICAL EQUIPMENT

Generating Equipment  
Switchboards  
Switchboard Meters  
Converters  
Heating Devices  
Lightning Arresters



Motors (Alternating Current)  
Motors (Direct Current)  
Arc Lamps  
Control Equipment  
Transformers  
Regulators

### Co-operative Service

Westinghouse Electric & Manufacturing Company, manufacturers of apparatus for both Generation, Application and Control of electric power, invite the members of the A. S. M. E. to use the facilities of our engineering department in the planning and selecting of electrical equipment.



Westinghouse Type SK direct-current motors are designed for general constant and adjustable speed service, and therefore find extensive application to machines used in practically every industry especially for driving machine tools and for other services where the load is frequently started, stopped or reversed. The SK motors are of steel construction, with few parts, all of which are readily accessible. The materials used have been selected so as to combine light weight with great mechanical strength.

Westinghouse Type CS alternating-current motors are designed for general constant speed service and are therefore applicable for driving machines in every industry. They are made in all standard sizes from 2 to 650 horsepower, for all commercial voltages and frequencies.



Forged open-hearth steel is largely used in the construction, which not only provides great strength but reduces the weight of the inactive material and all overall dimensions to a minimum. The rotors are practically indestructible; the bearings have very liberal areas, are non-leaking and are protected from dust.

The efficiency, power factor, and overload capacity are unusually high since high efficiency means low operating costs. Special attention has been given to this point, not only at full loads but at fractional loads. As a result of these features, type CS motors can be depended on to operate with maximum economy and to give satisfactory service for years with little attention.





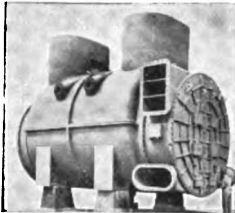
# WESTINGHOUSE ELECTRIC & MFG. CO.

## POWER EQUIPMENT

**Turbo-Generators from one to 100,000 Horse Power  
Condensers—Surface, Low-Level Jet and Barometric  
Stokers—Underfeed, Roney and Chain Grate**



**Power House Auxiliaries, such as small geared turbo-generators and geared turbines for Pump, Fan and Blower drive**



**Large Surface Condenser**

**COMPACTNESS** is a very important feature of all Westinghouse Condensers. This is especially true of the Jet type referred to later, and of the Unit Type Surface. All pumps are located directly beneath and the pump runners all mounted on one shaft, driven by one turbine or motor as demanded by local conditions.

**JET** Condensers are also built in large sizes—the largest to date being a Twin to serve a 45,000 kw. turbine. The twin type is often made use of when large capacity is required, not because the



**Twin Type Jet Condenser**

limit in size of the single condenser is reached, but because the twin type frequently can be better adapted to the requirements of the installation. It has the additional advantage of greater surety of uninterrupted operation, for, should it become necessary, the full load of the turbine may be carried on one "leg" with good vacua until the necessary inspection of the other half is completed. This is a feature which should not be overlooked by the prospective condenser purchaser.

The Westinghouse Leblanc Air Pump, used on all our Condensers, has become well known throughout the country on account of its very high efficiency. Being of the centrifugal type and removing the air by "water pistons" or water layers, it has the peculiar advantage of increasing in efficiency *at the time* highest efficiency is *most needed*—as the **VACUUM INCREASES**. Hence the efficiency of the Leblanc Pump rises until maximum air scavenging is attained. The absence of reciprocating parts, valves and clearances, enables it to far exceed the reciprocating pump in efficiency and continuity of service.

Westinghouse Condensers are unexcelled in the ability to maintain high vacua, simplicity of construction, reliability and compactness.

Because of their exceptional performance, Westinghouse Condensers have become generally known throughout this country and abroad as **HIGH-VACUA Condensers**.

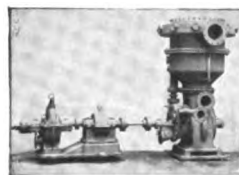
They are installed and operating in many parts of the world—Peru, Russia, Brazil, Porto Rico, Manchuria, Cuba, New Foundland, Japan, Hawaii, New Mexico, British West Indies, Alaska, Siberia and other foreign lands. Only Condensers of **UNDISPUTED RELIABILITY** could have become so widely known and used.

At the present time Westinghouse Surface Condensers are being built to serve turbines up to 100,000 Horse Power.



**Unit Type Surface Condenser**

97



**Small Low Level Jet Condenser**

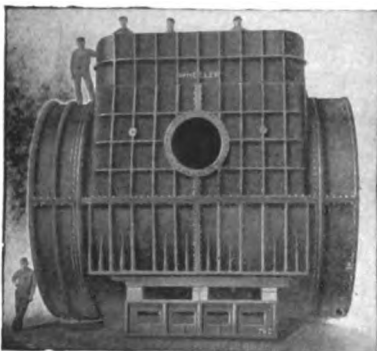
## WHEELER CONDENSER AND ENGINEERING CO.

MAIN OFFICE AND WORKS:

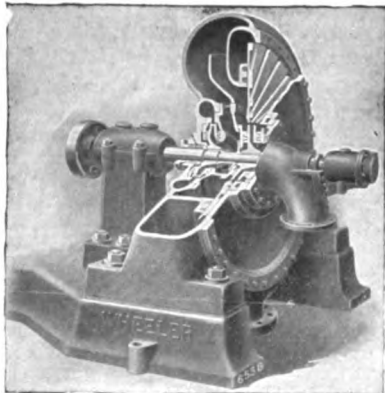
CARTERET, NEW JERSEY

BRANCHES: NEW YORK, BOSTON, PHILADELPHIA, CHICAGO, ST. LOUIS, ST. PAUL, CINCINNATI, PITTSBURGH, DALLAS, CLEVELAND, DENVER, SAN FRANCISCO, SALT LAKE CITY, LOS ANGELES, SEATTLE, TUCSON, ARIZ., CHARLOTTE, NEW ORLEANS, ATLANTA, LONDON, YOKOHAMA, TRIESTE, MELBOURNE, PARIS.

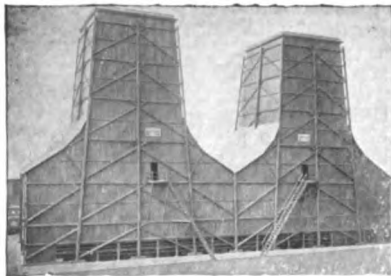
Manufacturers of Complete Condensing Equipment Including Tubes



Wheeler High Vacuum Surface Condenser



Combined Turbo Air Pump and Condensate Pump



Wheeler-Balcke Natural Draft Tower of  
500,000 Gallons per Hour Capacity

### HIGH VACUUM SURFACE CONDENSERS

For turbines of any capacity, condensing equipments operating on wet or dry system, with tube surface of condenser arranged to give best distribution of steam for high efficiency and maximum rate of heat transmission.

### HIGH VACUUM JET CONDENSERS

For turbines of any size to maintain vacuum of 28 inches and up. Built on the countercurrent "rain type" principle to insure maximum temperature of discharge water, and, therefore, minimum quantity of water, and minimum pumping cost.

### WHEELER TURBO AIR PUMPS

High Speed Rotary type for jet or surface condensers. Direct connected to turbine or motor. Combined with condensate pump in one casing or independent type.

### WHEELER-EDWARDS AIR PUMPS FOR AIR AND CONDENSATE

Eliminate expense of independent air and hot well pumps. No suction or bucket valves.

### WHEELER ROTATIVE DRY VACUUM PUMP

Will maintain a vacuum within .5" of barometer. For high vacuum jet condensers and large surface condensing equipments. Clearance effect reduced by an equalizing port.

### CENTRIFUGAL PUMPS FOR ALL SERVICES

Circulating, tail water and hot well pumps for condensers and high efficiency single stage pump for all purposes. Pumps of all sizes driven by motor, steam turbine or engine for water works, irrigation, etc.

### FORCED DRAFT STEEL TOWERS

Recommended for efficient cooling of water where ground space is limited, and smallest size tower must be used.

### NATURAL DRAFT WOODEN TOWERS

For manufacturing and industrial plants, also central stations where a supply of cooling water is not available. Operating cost consists of water pumping cost only. Designed for special low lift so as to reduce this cost to the minimum.

### BRASS AND COPPER TUBES

All standard sizes and gauges manufactured in large Wheeler mill particularly for condensers.

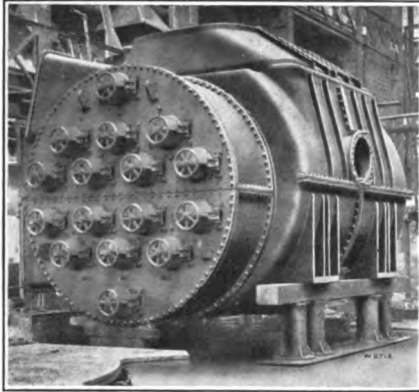
## **WORTHINGTON PUMP AND MACHINERY CORPORATION**

115 BROADWAY, NEW YORK

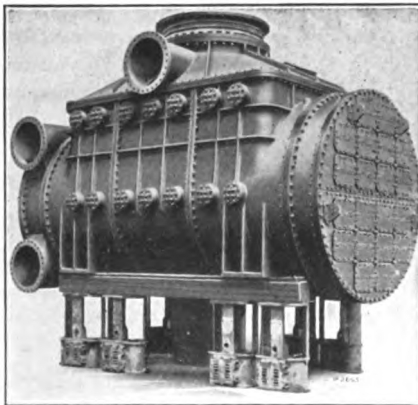
WORKS, HARRISON, N. J.

**Manufacturers of Surface, Barometric and Centrifugal Jet Condensing Systems, Complete with Auxiliaries; Cooling Towers; Duplex Direct-Acting, Centrifugal, Turbine and Multi-State Pumps for Every Service, Boiler Feed, Elevator, Fire, Pressure Pumps; Water Motors; Water Works, Sewage and Drainage Pumping Engines**

### **WORTHINGTON SURFACE CONDENSERS**



Containing 35,000 ft. surface and having special quick-opening handhole plates on water boxes; being installed by the New York Central R. R. Co. at their Port Morris Station.



This surface condenser containing 20,000 ft. surface, is now being installed for the Municipal Council of Shanghai, China, in connection with a 10,000 kw. General Electric steam turbine.

Attention is called to the special construction showing provision for unusually high test pressure on the condenser shell.

W 366.8

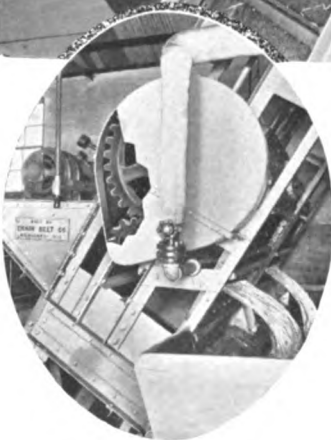
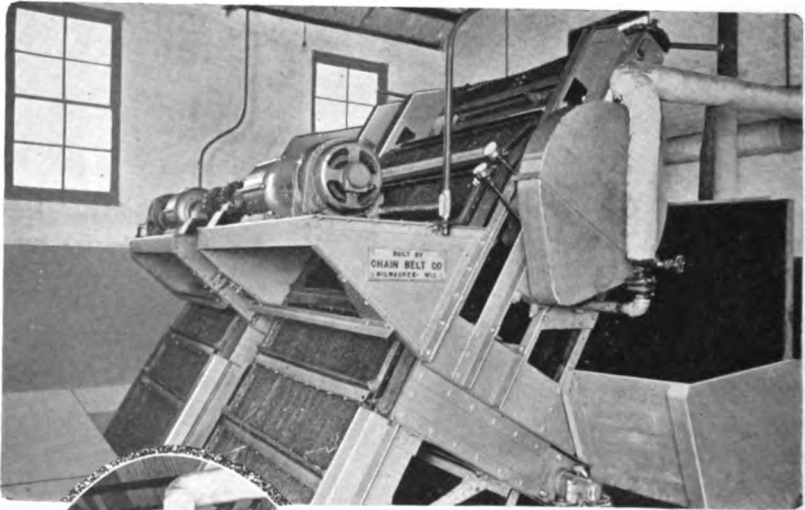
## CHAIN BELT COMPANY

Established 1891

734 PARK ST., MILWAUKEE, WIS.

Pioneer Manufacturers of Rex Traveling Water Screens

### REX TRAVELING WATER SCREENS



In early times man realized the importance of clean water for his own purposes and devised methods of obtaining it. He had to drink water to live and soon found that this water must be clean water.

In modern times man's mechanical helpers require enormous quantities of water and to give the best service these machines must be provided with clean water. Not the filtered, germ-free liquid necessary for the human mechanism, but

a degree of cleanness which will eliminate trouble in power-producing or industrial plants.

Previous to the development of the Rex Traveling Water Screens, the common method of removing foreign matter from industrial water supplies was to use stationary bars or screens. These required cleaning by hand at frequent intervals and were a constant source of trouble and annoyance.

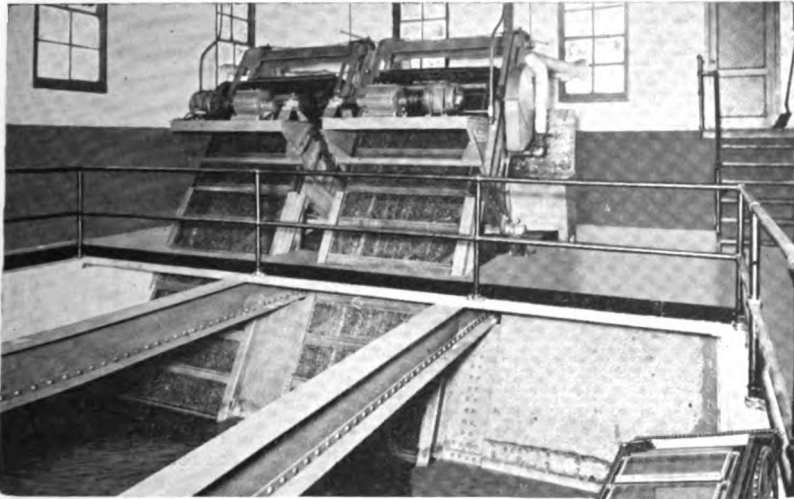
## CHAIN BELT COMPANY

Established 1891

734 PARK STREET, MILWAUKEE, WIS.

Manufacturers of Rex Chain, Rex Concrete Mixers and Rex Pavers

### REX TRAVELING WATER SCREENS



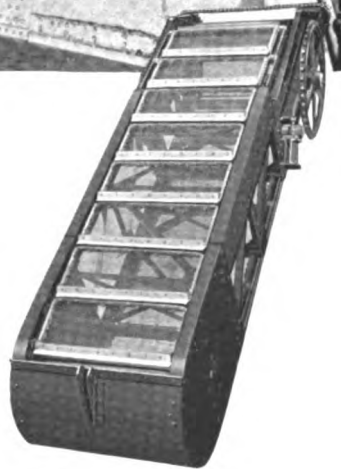
The Rex Traveling Water Screen was designed to overcome these drawbacks.

It consists of an endless series of tightly stretched wire screens traveling over head and foot sprockets and enclosed in a steel frame. The action is continuous and the screens are self-cleaning.

All debris or refuse is removed from the water and is disposed of through a refuse trough.

The illustrations show the Rex installation at the plant of the Solvay Process Company, Detroit, Michigan, and many others are now operating in various parts of the country.

The screen batteries are flexible and may consist of one or a dozen units depending upon the volume of water used.



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## SPRAY ENGINEERING COMPANY

93 FEDERAL ST., BOSTON, MASS.

Engineers—Manufacturers

### "SPRACO" EQUIPMENT FOR COOLING CONDENSING WATER



**Spray Cooling Equipment Installed over Natural Pond**

Spray Cooling Ponds equipped with our special "Spraco" Cooling equipment require only from five to seven pounds pressure per square inch at the nozzle. With this pressure, the water is thrown to a height of from five to seven feet above the tip of the nozzle in a uniform, dense, conical spray. A current of air is created in an upward direction around each nozzle due to its driving effect as well as to the heating effect which the spray has on the air in contact with the water, thus rapidly carrying away the warm, moist air produced and replacing it with cool, dry air brought in over the surface of the pond.

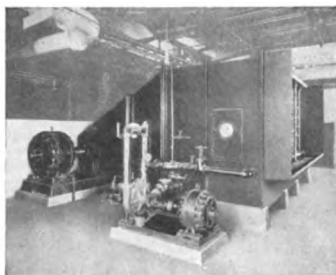
We find from our experience in designing over four hundred ponds, now in successful operation in the United States and other countries, that it is impossible to lay down exact rules for the design of these ponds, as local conditions make each case a special problem. Hence, if the amount of water to be cooled, the amount of steam condensed in heating this water, the cooling or vacuum desired, as well as the dimensions of the space available for the installation and whether on ground or roof are given us we will be pleased to send complete specifications and sketch of arrangement, best suited to conditions given.

### "SPRACO" AIR WASHERS FOR STEAM TURBINE GENERATORS

As the capacity of the electric generator is directly dependent upon its temperature, which in turn depends upon the air conditions, an ample supply of cool, clean air is of great importance. Dust or soot deposited within the machine greatly reduces the efficiency of air as a cooling medium.

As generators usually reach maximum efficiency at or above full load, our "Spraco" Washers produce the double benefit of higher efficiency and greater capacity.

An average gain in capacity of only 5% on a 5,000 kw. machine means an increase of 250 kw. At \$20 per kilowatt per annum this gives \$5,000 increased earning capacity in one year. The increase for four months would about cover the cost of the air washer, which would thus pay for itself quickly, and then provide a very large return on the investment.



**Typical Air Washer Installation**

The cost of cleaning a large generator is high and where the air is unwashed, must be undertaken at least twice a year. This can be largely avoided by the use of our "Spraco" Air Washers.



## RUSSELL B. HOBSON

NEW BRIGHTON, N. Y.

### THE HOLLY GRAVITY RETURN SYSTEM

#### For the Return of High Pressure Condensation from Steam Piping to Boilers

We are supplying Holly Systems to many large steam plants because in most instances the Engineers are long familiar with Holly Service. Our resale orders exceed our new business.

The Holly System has been described as "a principle in operation," having no mechanism to get out of order, and, having a very large capacity, it offers for these combined reasons the most reliable method of caring for high pressure steam piping.

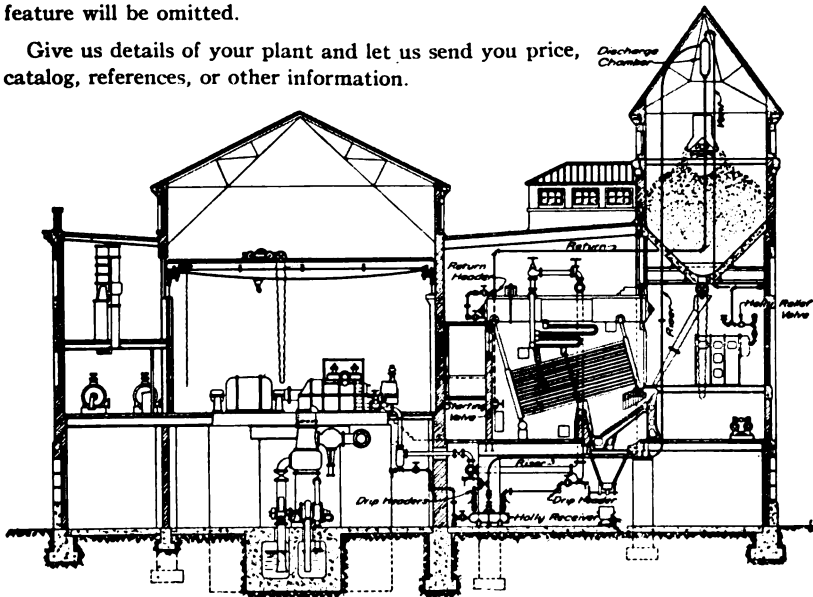
The occasional presence of water in the mains will inevitably produce costly leaks which can be most surely avoided by keeping all branches to prime-movers well drained and all dead ends at full temperature.

Having in mind the very heavy capital outlay involved in modern steam piping, it is but fair that it should have the protection of the best available drip system.

The first cost of a Holly System is not essentially different from other means, and the economy is uniformly better.

When you order we prepare your steam-fitter's diagram from your plans of the job, and, having laid out over 400 Systems, you will find that no necessary feature will be omitted.

Give us details of your plant and let us send you price, catalog, references, or other information.



Typical Elevation of Holly Gravity Return System

# CRANE CO.

Founded by R. T. Crane 1855

836 So. MICHIGAN AVE., CHICAGO, ILL.

Cable address, Cranecoy, Chicago

Branches in Fifty-two Cities

Cast Steel Valves and Fittings; Cranetilt Steam and Vacuum Traps; Valves, Cocks and Fittings in Brass, Malleable Iron and Cast Iron; Steam Specialties; Complete Piping Equipment; Pipe Bends; Pipe Fitters' Tools; Engineers' Supplies, Etc.

## CRANE CAST STEEL VALVES AND FITTINGS

We have been manufacturing for some time a line of steel fittings to meet a steadily growing demand for a superior grade of goods, especially adapted for High Pressure, Saturated and Superheated Steam Lines and Extreme Hydraulic Service. These are suitable for steam working pressures up to 400 pounds, and for superheat up to a total temperature of 800 degrees F. We are prepared to supply Pop Safety, Gate, Blow-Off Valves, and all other material to comply with the A. S. M. E. Boiler Code.



No. 9A  
Rising Stem Gate  
Valve with By-Pass



No. 28A  
Stop Check Valve



No. 23A  
Angle Valve



No. 101D Elbow



No. 105D Tee  
Extra Heavy  
Cast Steel Flanged  
Fittings.

## GENERAL SPECIFICATIONS

For Steel Valves

CAST STEEL Body, Bonnet, Disc and Yoke

MONEL METAL Seats

ROLLED MONEL METAL or STEEL Stems

## CRANE FORGED STEEL VALVES AND FITTINGS

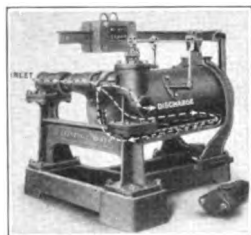
are suitable for pressures up to 10,000 lbs. depending on the article and size.



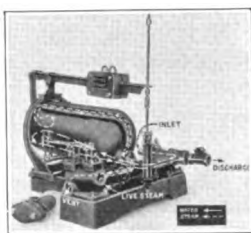
We carry a large stock of cast steel valves and fittings.



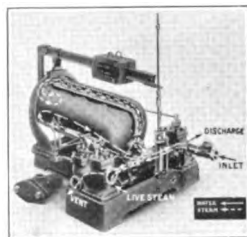
## CRANE CO.



**NON-RETURN TRAP**  
Made in sizes  $\frac{1}{4}$  to 3 inch;  
capacities up to 112,500  
pounds of water an hour.



**DIRECT RETURN TRAP**  
Made in sizes  $\frac{1}{4}$  to 4 inch;  
capacities up to 28,000  
pounds of water an hour.



**LIFTING AND VACUUM TRAP**  
Made in sizes  $\frac{1}{2}$  to 4 inch;  
capacities up to 28,000  
pounds of water an hour.



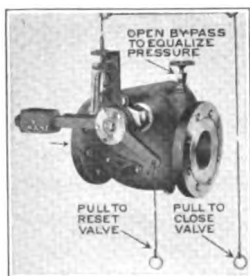
**ELECTRICALLY  
OPERATED VALVE**

**CRANE CO.**  
was awarded the  
**GRAND PRIZE**

the  
**HIGHEST AWARD MADE**  
on Equipment for the Transmission and  
Control of Steam, Water and Gas,  
by the  
International Jury of Awards of the  
Panama-Pacific International Exposition,  
at San Francisco, 1915.

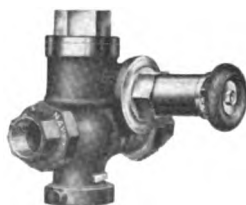


**CYLINDER  
OPERATED VALVE**

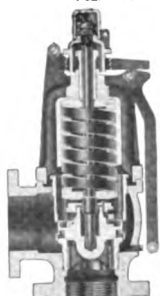


**EMERGENCY ENGINE  
STOP VALVE**

The frequency of accidents which require the shutting off of steam instantly has led several states to require by law a quick-closing Engine Stop Valve on the steam lead to each engine.



**PRESSURE REGULATOR**  
For steam and air.



**OUTSIDE SPRING  
AND YOKE POP  
SAFETY VALVE**

Conform to all requirements for stationary and marine boilers, A. S. M. E. Boiler Code and the United States Board of Supervising Inspectors of steam vessels.



(Continued on next pages)

(Continued from preceding pages)

## **CRANE CO.**

**CHICAGO, ILL.**

### **SUMMARY OF CRANE PRODUCTS**

We give on this and the following page a description of our line. We carry in stock at our branch houses a large supply of the goods listed below and are prepared to furnish without delay Special Valves, Fittings, etc., to meet specific requirements or conditions.

The term Standard is applied to products intended for steam working pressures not exceeding 125 pounds. The Low Pressure Fittings, etc., may be used for Steam Working Pressures up to 25 pounds, while the Medium Goods are intended for 175 to 225 pounds. The Extra Heavy are designed for Steam Working Pressures up to 250 pounds.

The proportionate Water-Working Pressure may be taken as follows: Low Pressure, Standard and Medium, 40 per cent greater than the steam pressure on sizes 12 inch and smaller; sizes 14 inch and larger, 20 per cent greater.

### **STANDARD GOODS**

We manufacture brass Globe, Angle and Cross Valves, screwed, in sizes from  $\frac{1}{8}$  to 4 inches; and the flanged pattern from  $\frac{3}{4}$  to 4 inches. The brass Check Valves are made in many patterns, the sizes of which run from  $\frac{1}{8}$  to 3 inches. The brass line also includes: Hose, Garden Hose, Coke Oven, Needle Point, Straight-Way and Hose Gate. Our lines of Radiator Valves and Fittings, brass Steam and Gas Cocks are complete. The Cast Iron material includes Cocks of various patterns; Globe, Angle and Cross Valves with yoke patterns; the sizes ranging from 2 to 16 inches. We make Brass and Cast Iron Pipe Fittings in both the screwed and flanged patterns as well as Malleable Pipe Fittings screwed. With the Standard Goods are also included iron Gate Valves, Expansion Joints with iron body and brass sleeve, Railing Fittings, Drainage Fittings, Steam Fitters' and Engineers' Tools, Pipe Bends, and Pipe Supports, Brackets, etc.

### **LOW PRESSURE GOODS**

The regular low pressure Gate Valves are made in several patterns and in sizes up to 72 inches. The low pressure Pipe Fittings are of the flanged pattern and include Elbows, 45 degree Elbows, Tees, Reducing Tees, Crosses, Reducing Crosses, Long Radius Elbows, Base Elbows and Tees with square and round base and Taper Reducers.

### **MEDIUM PRESSURE GOODS**

This line includes the Crane Navy Globe, Angle, Cross and Check Valves made of Crane Special Brass, the screwed pattern being made in sizes ranging from  $\frac{1}{4}$  to 4 inches and the flanged pattern from  $\frac{3}{4}$  to 4 inches. The brass Gate Valves come with non-rising stems, either screwed or flanged, while the rising stem pattern has a yoke and is screwed. We also make in the medium class, Globe, Angle and Cross Valves with Ferrosteel body, flanged in sizes ranging from 2 to 12 inches; the Gate Ferrosteel Valves are made in sizes 2 to 24 inches.

## **CRANE CO.**

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### **EXTRA HEAVY GOODS**

Under this heading will be found Valves and Fittings for Steam working pressures up to 400 pounds and for superheat up to a total temperature of 800° F., depending on the article and size. The Extra Heavy line includes Gate, Globe, Angle, Cross, Swing Check, Automatic Stop Check Valves, Expansion Joints with regular and special traverse, and with or without anchor base, Flanged Fittings, various styles of Companion Flanges, etc., made in Ferrosteel and Cast Steel; Crane Special Brass, Gate, Globe, Angle, Cross and Check Valves; Cast Iron, Malleable, Brass and Forged Steel Screwed Fittings and Screwed and Flanged Unions.

### **HYDRAULIC GOODS**

The complete line includes material for various water-working pressures up to 10,000 pounds, depending upon the article and size. It includes Ferrosteel Gate Valves with Non-Rising Stem, and Rising Stem and with or without bypass, Swing Check Valves, Flanged Fittings and Companion Flanges, sizes ranging from 1½ to 12 inches; Crane Hard Metal Gate, Globe, Angle and Check Valves in sizes ¾ to 2½ inches; Cast Steel Gate and Check Valves, Flanged Fittings and Companion Flanges and Forged Steel Valves, Fittings and Unions; Malleable Iron, Brass and Forged Steel Screwed Fittings.

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### **PIPE**

We can supply promptly Wrought Pipe—either black or galvanized—Seamless Drawn Brass and Copper Tubing in iron pipe sizes, Standard Weight Spiral Riveted Pressure Pipe, Straight Steam Steel Riveted Pipe. We are prepared to furnish complete piping equipment, bends, etc., ready for erection.

### **SPECIALTIES AND TRIMMINGS**

These are Pop Safety Valves, Automatic Exhaust Relief Valves, Stop Check Valves, Emergency Engine Stop Valves; Chicago Railroad and Navy Unions; Boiler Fittings, Crane Cement for making tight pipe joints, Steam Whistles, Water Gauges, Cocks, Pressure and Vacuum Gauges, Fusible Plugs, Back Pressure Valves, Blow-off Valves, Blow-off Crosses, Pressure Regulators, Float Valves, Exhaust Heads, Flexible Joints, Cranite Packing, Pipe Machines, Steam and Oil Separators, Crane Vacuum Oil Separators, Machine Bolts.

### **POCKET CATALOGUE**

The No. 50 Crane catalogue lists our complete line in compact form. It will be sent upon request.



# THE DARLING PUMP & MFG. CO. Ltd.

WILLIAMSPORT, PA.

## SALES OFFICES:

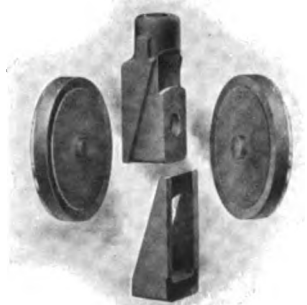
NEW YORK CITY  
149 Broadway

CHICAGO  
The Rookery

PHILADELPHIA  
Commercial Trust Bldg.

**Manufacturers of Darling Gate Valves, Ball Check Valves, Fire Hydrants, Floor Stands, Indicator Posts, Valve Boxes**

## DARLING GATE VALVES



**Wedging Mechanism—Shown with Parts Separated**

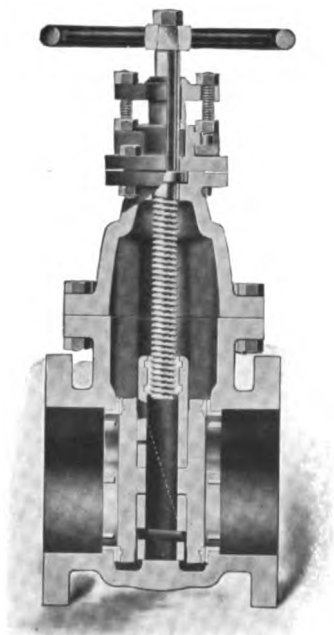
The Gate Discs being plain, no portion of the Wedging Mechanism is formed upon them. These Gate Discs revolve independently of the wedges, and independently of each other. The Revolving Gate Discs change their positions on the Seats each time the Valve is closed, thus distributing wear equally over entire faces of Gates and Seats, ensuring durability.

Gates released before opening, avoiding wear on Seats. Cannot stick or bind.

Simple, reliable, durable.

Darling Valves will remain tight longer than any others. They are made for all pressures and purposes.

The Darling Patented Gate Valve differs from all others in that it has Parallel Seats, Double Revolving Gate Discs and Compound Equalizing Wedges. The Wedging Mechanism operates between the Gate Discs and independent of them.



**Sectional View of Inside Screw Valve with Flanged Ends**

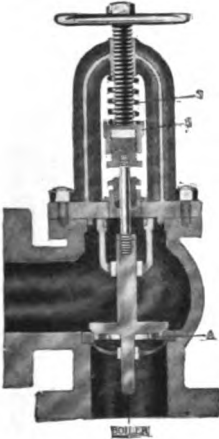
# THE THOMAS P. FORD COMPANY

407 BROOME St., NEW YORK, N. Y.

Manufacturers of The "Ford" Steam and Water Specialties

## THE "FORD" AUTOMATIC RETURN CHECK AND STOP VALVE

(Pat. 1916)



is a genuine improvement in non-return valves, the construction positively removing the objections encountered in the earlier types, sticking and chattering.

**Sticking** is caused by unequal expansion in the dash-pot. The "FORD" Valve has no dash-pot.

**Chattering** is caused usually by a dash-pot made of too free and loose a fit, in order to minimize sticking.

The "FORD" Valve employs an entirely different principle, which not only tries to avoid chattering, but which *does* avoid chattering.

As the "Ford" Valve is without dash-pot, we went about the prevention of Chattering from a different angle. Most valves are balanced, causing an equilibrium at a certain opening of piston. The "Ford" Valve is unbalanced and therefore does not possess the tendency to chatter. Furthermore, we figured the value of an apron or piston choke-off, "A," so that by the time steam is flowing from boiler into main in

any appreciable quantity, the valve disc itself is far enough from its seat to make wire-drawing an impossibility.

It is adjustable for sensitiveness to checking, a feature contained in no other valve.

**Superheated steam:** "Ford" construction produces the ideal valve for super-heat work. Contains *not a single snug fit* to stick under extreme temperatures.

**Triple Duty Valves** a trifle more intricate, of course, but a marvel of simplicity for the complex service involved.

Send for blue prints of  
THE VALVES THAT CANNOT STICK

Pump Regulating Valves  
High Pressure Tank Float Valves  
Steam and Water Reducing Valves, Etc.

—Complete the "FORD" Line—

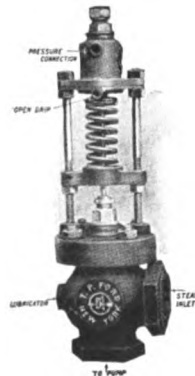


TRADE MARK

(Catalog on request)

Distributors for  
Middle West

Dickerson & Bolton  
1535 Lytton Bldg.,  
Chicago, Ill.



Pump Regulating  
Valve

# HOMESTEAD VALVE MFG. CO.

P. O. Box 1754, PITTSBURGH, PA.

Manufacturers of Homestead Valves and Other Specialties



**HOMESTEAD (Quarter Turn) PLUG VALVES OR COCKS**



The first illustration shows our Homestead Straightway Valve, with flanged connections. This pattern is used extensively as a boiler blow-off valve.

Homestead Valves are equally serviceable on all kinds of exacting or high pressure work.

The three-way and four-way valves as shown on the second and third illustrations are used as operating valves on air, water, steam and for many other purposes.

Homestead Valves are so constructed that they open and close with a quarter turn, operate easily and are free from leakage through the valve, the stuffing box or body.

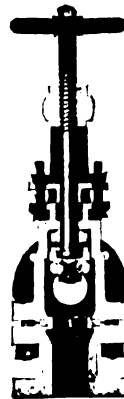
## HOVALCO (Blow-Off) VALVE

The valve here shown is a new pattern angle blow-off valve, Semi-steel body, and special composition seat. The disc and seat are reversible, renewable and can be reground. Note the accessibility and the ease with which the parts of this valve can be renewed.



Figure at left shows the "Homestead" and "Hovalco" valve combined. For boiler blow-off purposes, no better arrangement can be secured.

The advantages of the double blow-off arrangement are many, the "Hovalco Valve" can be repaired or renewed at any time without closing down the boiler. This is done by closing the "Homestead Cock," while the repairs are being made. The best power plants being built are specifying this arrangement of blow-off valves. In accordance with the Am. Soc. M. E. Boiler Code.



Section of Hovalco Valve

*Catalogue of our complete line sent upon request.*



# J. E. LONERGAN CO.

211-215 RACE ST., PHILADELPHIA, PA.

Manufacturers of Boiler, Steam and Gas Engine Specialties



Model "B"



## POP SAFETY VALVES

Were first made under Lynde Patents issued in the year 1872, and have since been improved upon by our corps of capable engineers of long experience who with their combined skill have brought the LONERGAN POP SAFETY VALVE up to its present state of excellence.



Model "D"

### Points of superiority:

1. Does perfect work while in service.
2. Repairs practically nothing.
3. Has long life.
4. Always seats perfectly.
5. *Great relieving capacity* as it is the only valve on the market having an expansion chamber above the seat, with baffle plate over that, so as to get the benefit, as the steam lifts the valve off its seat, of both the compressed and expanded steam, which construction gives the valve a high lift.
6. *Adjustable screw ring*, very easy to regulate—used to govern number of pounds steam relieved before valve closes.
7. Springs of the best grade PENNSYLVANIA ANALYSIS OPEN HEARTH STEEL, of a fibre stress suited for best results.
8. All valves made with bevel seats, except when otherwise ordered.

#### "Protected Spring" Pop Safety Valve

##### Model "B"

For Water Tube Boilers, etc.

Encased Spring, to protect it from contact with live steam.

LonerGAN Patent Double Eccentric Lifting gear, the best lifting device made.

Good for working pressure up to 300 lbs.

Testing yokes furnished at small extra charge.

Fitted for LOCK to prevent their being tampered with.

Recommended for use in Power Stations, Electric Light Plants, Large Manufacturing Plants.

Sizes 2", 2½", 3", 3½", 4", 4½", 5" and 6". Iron Body Bronze Mounted, with either bronze or nickel seats.

#### "Marine" Pop Safety Valve

##### Model "D"

For use on Marine Boilers.

General Specifications same as Model "B."

Handle on top allows valve to be turned on its seat when under steam pressure.

Repairs easily made as valve can be broken below outlet, for seat repairs.

Complies with rules of:

United States Board of Supervising Inspectors of Steam Vessels.

Board of Trade, Great Britain.

British Lloyds.

Bureau of Veritas, France.

Sizes 2", 2½", 3", 3½", 4", 4½", 5" and 6". Iron Body Bronze Mounted.

#### Duplex Pop Safety Valve (Model "F")

Two valves in one base casting. Furnished with outlet at either end, or in center. Made in Bronze, Steel, Semi-Steel and Iron. Equipped with Rockershaft Lifting Gear so valves can be lifted in succession or simultaneously. Used largely by U. S. Government, Merchant Marine, etc.

**WATER RELIEF VALVES:** Good for working pressures up to 300 lbs. Recommended for use on Pumps, Hydraulic Elevators, Pipe Lines, Water Works, etc. Relieving capacity unequalled by any other make of valve on the market.

**CHIME WHISTLES:** Made in two types, MODEL "WV," Adjustable Lever with Valve, MODEL "WN," without valve. Bell diameter sizes from 1½" to 12". Bells of solid cast bronze and not built up with a web inside of a lap welded tube. Recommended for Marine and Stationary Work, Fire Alarms, etc.

*We also manufacture* Cylinder Relief Valves, Plain Whistles, Quick Closing Water Gauges, Automatic Closing Water Gauges, Chain Pull Gauge Cocks, Oil Cups, Grease Cups, Jelco G. G. Cutters.

# JENKINS BROS.

80 WHITE ST., NEW YORK

133 NO. SEVENTH ST., PHILADELPHIA

524 ATLANTIC AVE., BOSTON

300 W. LAKE ST., CHICAGO

JENKINS BROS., LIMITED

103 St. Remi St., MONTREAL

95 Queen Victoria St., LONDON, E. C.

JENKINS RUBBER CO., ELIZABETH, N. J.

**Manufacturers of Jenkins Bros. Valves; Sheet Packing, Pump Valves and other Mechanical Rubber Goods**

## JENKINS BROS. BRASS VALVES

Jenkins Bros. Brass Globe, Angle and Cross Valves, Standard Pattern, with Jenkins Renewable Discs, suitable for working steam pressures up to 150 pounds, or 250 pounds water. Regularly made in sizes  $\frac{1}{8}$  to 3 inches, screwed or flanged. Larger sizes in brass made from iron body patterns.

Jenkins Bros. Hose End Globe and Angle Valves, with Jenkins Discs of flexible rubber composition insuring tightness under cold water pressures up to 250 pounds. Sizes  $\frac{1}{2}$  to 3 inches, with or without cap and chain, in any style of finish required.

Jenkins Bros. Brass Horizontal, Angle and Vertical Check Valves, correspond to same standard as the Standard Pattern Globe and Angle Valves. Regularly furnished with Jenkins Disc of semi-hard composition which will soften slightly under the action of hot water. When specified for cold water, air or gas, a soft, flexible rubber disc is supplied, suitable for 150 pounds working pressure. Sizes  $\frac{1}{4}$  to 3 inches, screwed or flanged.

Jenkins Bros. Brass Swing Check Valves are made with globe-shaped bodies. Adapted for either horizontal or vertical installation. Furnished with Jenkins Disc, suitable for 150 pounds pressure. Sizes  $\frac{1}{4}$  to 3 inches, screwed or flanged.

Jenkins Bros. Brass "Y" Valves, besides their extensive use for blow-off service, are particularly desirable for handling muddy and gritty water, and thick heavy fluids. Sizes,  $\frac{1}{8}$  to 3 inches, screwed or flanged.

Jenkins Bros. Brass Gate Valves, Standard Pattern, especially desirable for plumbing or other service under working pressure 125 pounds steam or 175 pounds water. Made both inside screw and outside screw and yoke. Regularly have rough body, finished trimmings; but polished, nickel plated, wood wheel, brass wheel, or other special finish furnished when so ordered. Sizes,  $\frac{1}{4}$  to 3 inches, screwed or flanged.

Jenkins Bros. Brass Gate Valves, *Medium Pressure*, are especially designed for steam, or hot and cold water lines where high grade installation is required but pressure carried does not warrant use of the more expensive extra heavy pattern. They are guaranteed for 175 pounds steam, 250 pounds water. Sizes,  $\frac{1}{4}$  to 3 inches

## JENKINS BROS. IRON BODY VALVES

Jenkins Bros. Iron Body Valves, Standard Pattern, are heavier and considerably stronger than the average iron body valves. Have Jenkins Discs and renewable seat rings. Suitable for working pressures 150 pounds steam or 250 pounds water. Globe and angle valves, sizes 2 to 24 inches inclusive; cross valves up to 8 inches; horizontal, angle and vertical check valves 2 to 8 inches; all iron valves from  $\frac{1}{2}$  inch up; safety and back pressure valves in various patterns and sizes; standard pattern gate valves, with solid double-faced wedges, 2 to 30 inches; medium pressure, 2 to 18 inches, with or without by-pass. Flanges, A. S. M. E. standard dimensions.



Fig. 106  
Brass Globe Valve  
Standard Pattern



Fig. 352  
Brass Swing  
Check Valve



Fig. 370  
Brass Gate Valve  
Standard Pattern



Fig. 142  
Iron Body Globe  
Valve, Standard  
Pattern



Fig. 114  
Brass Hose  
Angle Valve



Fig. 124  
Brass Y Valve  
Standard Pattern



Fig. 270  
Brass Gate Valve  
Medium Pressure



Fig. 325  
Iron Body Gate  
Valve, Standard  
Pattern



# JENKINS BROS.

## JENKINS BROS. VALVES FOR HIGH PRESSURE

Jenkins Bros. Extra Heavy Brass Valves, Globe, Angle, Cross, Check and other patterns, are suitable for working steam pressures up to and including 300 pounds, or for water and air pressures up to 500 pounds. Carefully designed, well proportioned, handsomely finished, with the most approved features of construction. Sizes  $\frac{1}{4}$  to 3 inches.



Fig. 128  
Brass Globe  
Valve, Extra  
Heavy Pattern



Fig. 293  
Automatic  
Equalizing Stop  
and Check  
Valve



Fig. 204  
Iron Body Gate  
Valve, Extra  
Heavy Pattern  
Outside Screw  
and Yoke



Fig. 227  
Pump Valve

Jenkins Bros. Extra Heavy Iron Body Valves are suitable for working pressures of 250 pounds steam or 400 pounds water. Globe, angle and cross valves made in sizes 2 to 12 inches; valves from 5 inches up can be supplied with by-passes which are cast integral with the body. Horizontal and angle check valves, 2 to 6 inches; swing check valves, 2 to 8 inches; Y valves, 2 to 3 inches; automatic equalizing stop and check valves, 4 to 8 inches. Gate valves with inside screw or outside screw and yoke, in sizes  $1\frac{1}{2}$  to 24 inches. Valves can be furnished with by-passes, and their use is particularly recommended on sizes 8 inches and larger. All flanges, A. S. M. E. Extra Heavy Dimensions.

## JENKINS BROS. CAST STEEL VALVES

Jenkins Bros. Cast Steel Valves are made in globe, angle, gate and check patterns, which experience has shown are perfectly adapted for the severe conditions incident to high pressure superheated steam service. The valves are suitable for working steam pressures up to 350 pounds, and total temperature of 800 degrees F. Furnished in practically the same sizes as the Extra Heavy Iron Body Valves.

## MECHANICAL RUBBER GOODS

In this line we are offering engineering requisites which are the result of over 50 years of progressive effort. We are the original manufacturers of rubber composition discs for valves and unvulcanized sheet packing.

Jenkins '96 is the name of our high grade unvulcanized or self-vulcanizing packing, furnished in sheets or gaskets, and unsurpassed for all kinds of saturated steam joints. JENARCO is a vulcanized red sheeting. It is very tough and pliable, equally suitable for steam, hot or cold water, and other joints.

Jenkins Bros. Pump Valves are made from various compounds. There are pump valves of hard composition, particularly adapted for hot water, as with boiler feed pumps; for oils, acids, and other destructive fluids; semi-hard valves for high pressure cold water service as in mines and elevators, medium soft for cold water, very soft and flexible for low pressure cold water and air. When ordering, state the kind of service in which the valves are to be used, the fluid handled, pressure or head pump is working against, and in all cases give diameter, thickness and size of hole.

All genuine Jenkins Bros. Valves bear Diamond Trade Mark, and are absolutely guaranteed to be perfect in workmanship and suitable and efficient in the service for which they are designed.



Fig. 164c  
Iron Body Angle  
Valve with By-Pass,  
Extra Heavy Pattern

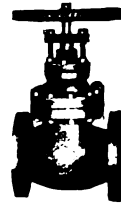


Fig. 203  
Iron Body Gate  
Valve, Inside Screw,  
Extra Heavy Pattern

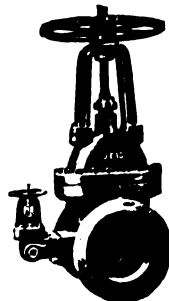


Fig. 204b  
Iron Body Gate  
Valve with By-Pass,  
Extra Heavy Pattern



A catalogue of all the Jenkins Bros. products, giving sizes, styles and list prices, mailed on request.

## THE KELLY & JONES CO.

GREENSBURG, PA.

Manufacturers of Cast Iron, Malleable, Brass and Steel Fittings; Brass, Iron Body and Steel Valves, Cocks, Etc., for Steam, Gas, Water, Air and Oil



Cast Iron Fitting

### CAST IRON, MALLEABLE AND BRASS FITTINGS

We make every conceivable style and size of screwed cast iron, malleable, brass and steel fittings and for all pressures.

All of our screwed fittings are recessed to permit of the easy entrance of the pipe and threads are cut true to gauge. Will not leak and each fitting a perfect product.



Malleable Fitting



Flanged Fitting

### FLANGED FITTINGS

We make a flanged fitting for every pressure and purpose, brass, iron or steel, and in all sizes, straight or reducing.

Dimensions and drilling in accordance with the latest established standards.

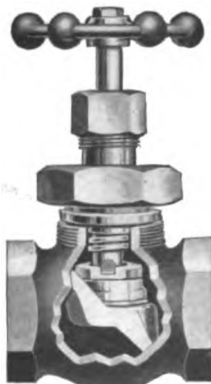


Reducing Flanged Fitting

### JENKINS TYPE KELLY & JONES BRASS VALVES

Practical—durable—efficient—economical. Will not leak and can be repacked under full pressure. These K-J Jenkins type brass valves are made of the highest grade steam metal, carefully machined, and are very attractive in appearance. Special pattern for 100 lbs., standard for 125 lbs.

Furnished in globe, angle, cross and check, screwed or flanged, and in all sizes.



"Excelsior"  
High Pressure Brass Valve

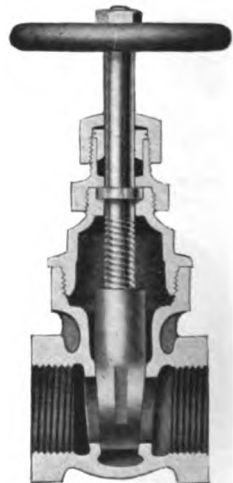
### "EXCELSIOR" HIGH PRESSURE BRASS VALVES

For high pressure service, 200 or 300 lbs. of live or superheated steam. Used extensively in modern steam plant construction and in the U. S. Navy. Can be furnished with or without yoke, screwed or flanged, globe, angle, cross and check. Sizes from  $\frac{1}{4}$ " to 4".

### BRASS GATE VALVES

The Kelly & Jones line of brass gate valves is most complete. Correctly designed and well proportioned and can be furnished screwed or flanged for the following pressures: 100 lbs., 125, 150, 175, 200, 250 and 1000 lbs. Made with outside screw and yoke if desired for 125 or 250 lbs. pressure.

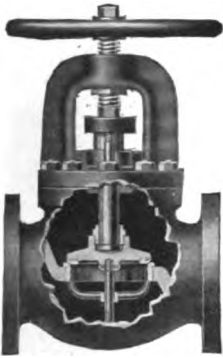
In addition to the solid wedge type illustrated we make brass gate valves with the double disc, either parallel or taper seats.



Brass Gate Valve

# THE KELLY & JONES CO.

Send for Catalog "O" illustrating and describing our complete line of valves and fittings.  
Our **NEW STEEL FOUNDRY** is fully equipped for making in "high quality" steel, any of the valves or fittings shown in our general catalog.

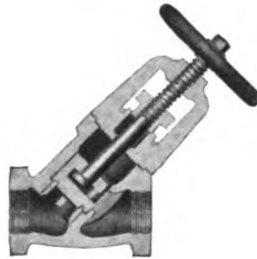


Iron Body Globe Valve

## IRON BODY VALVES

All styles and sizes for all pressures and purposes including globe, angle, cross, check and safety valves. Screwed or flanged, inside screw or O. S. & Y.

K. & J. blow-off valves, globe or angle, screwed or flanged, perform their function correctly and positively, and thereby prolong the life of the boiler. Built on scientific principles and have been in satisfactory use for years.



Globe Blow-Off Valve



"Saddle" Gate Valve

## "SADDLE" GATE VALVES

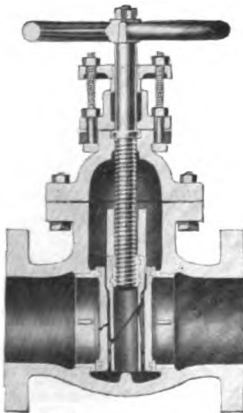
All Iron or Iron Body Brass Mounted

This saddle style is a very durable and compact valve, and economical, owing to the simplicity of construction. The steel saddle around the body of the valve holds the bonnet securely in place, and can easily be removed, permitting of access to the interior of the valve for cleaning or repair purposes. Opens to the left and has a rising spindle.

The solid disc in this valve is very narrow and V-shaped at the bottom, and can, therefore, be seated more readily when dirt and sediment are collected between the seats in the valve. Screwed or flanged, sizes  $\frac{1}{4}$ " to 6".



Iron Body Gate Valve  
Solid Wedge



Iron Body Gate Valve  
Double Disc

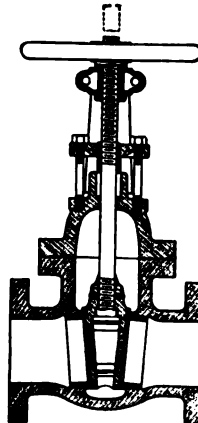
## IRON BODY GATE VALVES

Solid Wedge or Double Disc

Our iron body gate valves can be furnished screwed or flanged, with or without yoke and by-pass and for 25, 125, 175, 250 and 1000 lbs. pressure.

These valves are also made all iron for temperatures exceeding 325° Fahrenheit and for handling cyanides, acids and other solutions injurious to brass.

We also make these gate valves with the double disc, parallel or taper seats.



# PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.

PITTSBURGH, PA.

## BRANCH OFFICES AND AGENTS

NEW YORK OFFICE, 30 Church St.

DENVER, COLO., Mountain States Mach. Co.

CLEVELAND OFFICE, 1308 Rockefeller Bldg.

PHILADELPHIA, PA., 1323 Widener Bldg.

BIRMINGHAM, ALA., Young & Vann Sup. Co.,  
1809 First Ave.

SALT LAKE CITY, UTAH, Utah Eng. &  
Machinery Co.

BISBEE, ARIZ., Carl Clausen, Eng. Office.

SAN FRANCISCO, CAL., E. A. Keithley,

CHICAGO, ILL., 650 McCormick Bldg.

Rialto Bldg.

TORONTO, ONT.

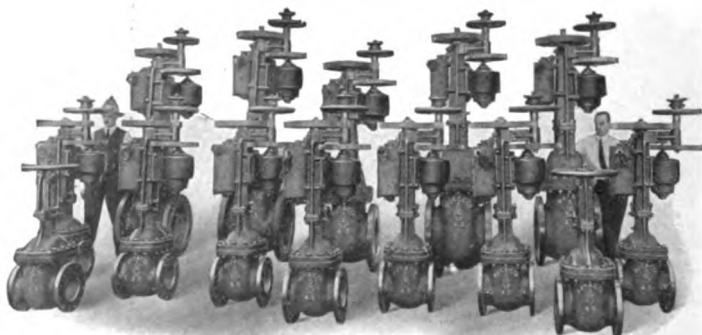
## Engineers, Manufacturers and Erectors

Exclusive Manufacturers of Gulland Automatic Stand Pipes

Valves, Fittings and Appliances of every description for Steam, Gas, Water, Air and Hydraulic Piping. Complete piping contracts executed—designed by experienced engineers, manufactured by skilled workmen under intelligent supervision and erected by expert fitters.

Special Valves and Sluice Gates for hydraulic installations, Motor Operated and Cylinder Operated. Hydraulic Operating Valves for blast furnace doors and bells, and for steel mill tables and rolls.

Special facilities for casting and machining large pipe fittings, furnace castings, etc.



Group of Motor-Operated Gate Valves

Pipe cutting, bending and welding. Branches and manifold outlets fabricated by the patented Interlock Method.



16" Welded Header with 18-4" Branches



# PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.

## STANDARD LINES OF GATE VALVES

### Specifications for material

Grey Iron—22,000 lb. per sq. in. tensile strength.  
Semi Steel—33,000 lb. per sq. in. tensile strength.

Parallel seat  
50 lb. working pressure  
100 lb. test pressure

Sizes 14" to 72" cast iron. Low pressure. For water, gas, air or exhaust steam. Extremely close face to face, invaluable in complicated piping connections.

Parallel seat  
125 lb. working pressure  
300 lb. test pressure

Sizes 2" to 48" cast iron. Standard pressure. For water, air, steam or gas. Fully bronze mounted. Especially adapted to water distribution.

Parallel seat  
200 lb. working pressure  
400 lb. test pressure

Sizes 1½" to 16" cast iron. Largely used for natural gas under the lower pressures. Furnished either all iron or iron body bronze mounted.

Parallel seat  
400 lb. working pressure  
800 lb. test pressure

Sizes 3" to 20" semi steel. In extensive use for the transmission of natural gas. Furnished either with or without bronze mountings.

Parallel seat  
500 lb. working pressure  
1500 lb. test pressure

Sizes 2" to 12". For water or oil at pressure noted. Semi steel with solid bronze mountings.

Parallel seat  
1000 lb. working pressure  
1500 lb. test pressure

Sizes 2" to 12" semi steel. High pressure gas valve used chiefly at the gas wells and on feeders in the gas fields.

Parallel seat  
1500 lb. working pressure  
2000 lb. test pressure

Sizes 2" to 10" semi steel. For hydraulic service and extreme natural gas rock pressures.

Taper seat  
175 lb. working pressure  
500 lb. test pressure

Sizes 2" to 16" semi steel. A valve for medium steam pressures from 125 lb. to 175 lb. where a less expensive valve than the 250 lb. type is desired.

Taper seat  
250 lb. working pressure  
800 lb. test pressure

Sizes 1½" to 28" of semi steel with solid bronze mountings for ordinary steam pressures. Sizes 2" to 24" for superheat steam up to a temperature of 500 degrees Fahrenheit of cast steel with full monel mountings, monel stems and cooling chamber to protect packing.

Taper seat  
1000 lb. working pressure  
2000 lb. test pressure

Sizes 2" to 10". The strongest valve possible to make in its weight, all surfaces being cylindrical or spherical segments.

Gate valves for any pressure

Designs and quotations furnished for valves for special conditions or higher pressures. Materials used are those best adapted to service.



50 lb. Parallel Seat Gate Valve. Close Pattern



14" Cast-Steel Gate Valve for Superheat Steam



4" 1000 lb. Gas Line Gate Valve

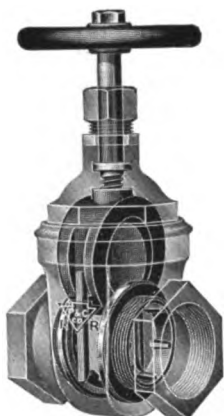


8" 1000 lb. Hydraulic Gate Valve

# PRATT AND CADY CO., INC.

HARTFORD, CONN.

Manufacturers of Valves, Cocks and Hydrants



Renewable Seat Gate Valve

## RENEWABLE SEAT GATE VALVES

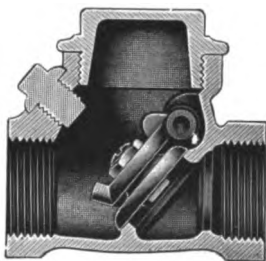
Bronze and Iron

All styles for all pressures. Sizes up to 24 inches. With renewable seat rings, held in place by separate retaining rings easily removable.

The seat rings are independent rings of bronze, or any special metal or material best adapted for the service in which the valve is to be used. The gate is a double-faced wedge-shaped casting, with side grooves by means of which it slides on guides in the valve body.

Gauges are used in machining all parts to insure their accuracy and interchangeability.

The guides in the bodies are of equal thickness, and the wedge can be taken out of the valve and replaced with the opposite faces in contact, and will give an accurate fit. The importance of this in making repairs is obvious. These valves being double seated, can be used with the pressure applied at either end.



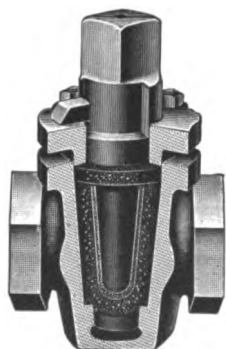
Regrinding Swing Check Valve

## REGROUNDING SWING CHECK VALVES

Bronze and Iron

All styles for all pressures, sizes up to 36 inches.

The design combines pressure resistance with easy flow lines. Material (of bronze valves) is 86% pure copper. Each valve is tested to an adequate pressure. All seats are carefully ground. Assembly is done by expert mechanics. The interior construction permits the replacement of any working part without removing valve from line. For regrounding no tool is necessary but a wrench and brace and bit.



Asbestos-Packed Cock

## ASBESTOS-PACKED COCKS

Bronze and Iron

Made in sizes  $\frac{1}{8}$  inch to 8 inches, for all pressures.

The dovetailed, U-shaped grooves in the body are packed with prepared asbestos. An asbestos ring is used on the shoulder of the plug for top packing.

The plug is of standard taper carefully finished and barbed to render it rustless. It has no metallic bearing, coming in contact only with asbestos, the elasticity of which compensates for the differential expansion and contraction of the plug and body. The gland admits of adjustment by means of its bolts.

These cocks give exceedingly satisfactory results as boiler blow-offs and water column blow-offs, between check and boiler, between water column and boiler, and they do work where ground plug cocks, globe, angle or gate valves fail.

# PRATT AND CADY CO., INC.

## ASBESTOS DISC GLOBE AND ANGLE VALVES

Made in sizes  $\frac{1}{4}$  inch to 3 inches for 150 lbs. pressure.

The stuffing box gland is long, heavy and well fitted.

The spindle collar, and its point of contact with the bonnet, have specially smooth surfaces and make a steam-tight joint when valve is fully open.

The disc holder is guided by four splines in the body, assuring perfect alignment at all times. The disc holder is of the horseshoe type, and can be removed and replaced, the only tool necessary therefor being a wrench to unscrew the bonnet.

The seat is rounded, thus preventing the settling thereon of any substance that might hold the disc from going squarely to its place. The bronze in these valves is approximately 86% pure copper.

## CAST STEEL GATE VALVES

(For Superheated Steam)

All tested to a hydrostatic pressure of 800 lbs., suitable for 250 lbs. pressure and 200 degrees superheat.

All valves  $2\frac{1}{2}$ " to 6" are equipped with cast steel bodies, bonnets, yokes and nickel-bronze wedges.

Valves 7 inches to 16 inches have cast steel wedges.

The seats and faces of the wedges are made of nickel-bronze, securely fastened in place so that they cannot work loose.

Stems are cold rolled steel.

All bolt holes are spot faced.

Bonnet joint is packed with the best grade of super-heat packing.

The end flanges have  $\frac{1}{8}$ " raised faces, extending full width inside of bolt holes, with smooth finish.

All bolts have hexagon heads and nuts, with their under sides semi-finished.

The discs can be furnished either split or solid wedge pattern.

Stuffing box is made with hinge bolts, very deep for square packing.

## AUTOMATIC NOISELESS STOP AND CHECK VALVES

Made in iron body in sizes 2" to 10" from both globe and angle patterns, with either screwed or flanged ends for pressures up to 250 pounds to the square inch.

For use between the main steam header and each boiler of a battery.

Closes automatically if the boiler pressure should be reduced through any cause.

Acts as an equalizing valve between the units of a battery, remaining closed until the boiler pressure reaches the same degree as that in the header.

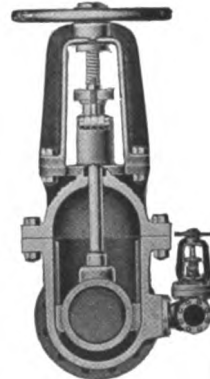
Can be used as a positive stop valve by using the hand wheel to force the disc to its seat.

The internal dash-pot, the piston, and the disc are made of bronze to prevent corrosion.

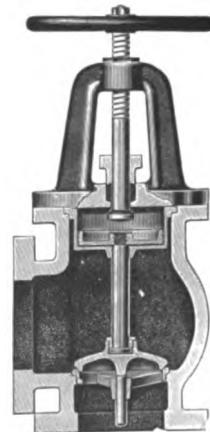
If required for controlling superheated steam, these valves can be furnished in cast steel with nickel-bronze working parts. When so made, they are suitable for pressures up to 250 pounds and total temperatures not exceeding 800 degrees Fahrenheit.



Asbestos Disc Globe Valve



Cast Steel Gate Valve



Automatic Noiseless Stop and Check Valve

# JULIAN D'ESTE COMPANY

26 CANAL ST., BOSTON, MASS.

Brass Founders, Finishers and Machinists. Sole Manufacturers of Curtis Engineering Specialties

**PRODUCTS:** Damper Regulators, Improved Pressure Regulators, Improved Pump Regulators, Water Pressure Regulators, Expansion Trap, Return Steam Trap, Balanced Steam Trap, Relief Valve for Steam and Water, Steam Separator, Temperature Regulator, Pump Governor and Pump, Blower Valve, U. S. Ball Cock, Etc.

## THE CURTIS IMPROVED (PATENT) DAMPER REGULATORS

The plunger is operated by steam direct from the boiler, and the whole pressure in the boiler is therefore available to operate the damper if needed. In practice, only enough pressure is used to lift the weight, usually not more than ten pounds to the square inch on the plunger.

The motion of the damper will begin to change from one direction to the other on a variation of steam pressure of one-half of a pound either way from the point at which it is set to operate.

We guarantee a saving of ten per cent of the fuel over the best hand regulation or the old style (diaphragm and lever regulator), and it often reaches fifteen per cent.



Damper Regulator

They are sent on thirty days' approval and will pay their cost by the saving of fuel in one year. Three Standard Sizes.

## IMPROVED STEAM PRESSURE REGULATORS

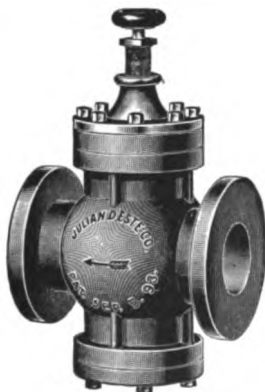
This regulator is made entirely of metal, occupies the same space as a globe valve for the same size pipe, and is very simple and sensitive.

By its use steam may be maintained at high pressure in boilers, and yet be reduced for heating to two or three pounds.

In the best engineering practice the exhaust steam of the engine and elevator is turned into the heating system of a building, and the Regulator automatically supplies just the amount lacking to maintain constant pressure in the pipes and radiators.

Standard sizes for  $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1, 1  $\frac{1}{4}$ , 1  $\frac{1}{2}$ , 2, 2  $\frac{1}{2}$ , 3, 4, 5, 6, 7, 8, 10 and 12 inch pipe.

A lockup top furnished at small additional cost.

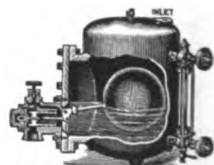


Steam Pressure Regulator

## THE CURTIS BALANCED STEAM TRAP

Some Points of Superiority

1. A perfectly balanced valve.
2. An absolutely frictionless valve.
3. The valve can be removed without breaking a joint, starting a gasket, or taking out a bolt.
4. The valve being frictionless and balanced, the whole power of the float is available for opening and closing it.
5. The copper float is perfectly spherical, as hermetically sealed as a glass globe, is of uniform thickness and warranted strong and tight at 250 lbs. pressure.
6. It has a pass-by valve to insure constant operation.
7. Each trap will operate perfectly on pressures varying from one to 250 pounds.



Balanced Steam Trap

### PRICE LIST

Size and Condensing Capacity in Feet of One-Inch Pipe		
No. 000,	\$15.00 for 1,000 feet	$\frac{1}{2}$ in. inlet and outlet
No. 00,	20.00 for 2,000 feet	$\frac{1}{2}$ in. inlet and outlet
No. 0,	25.00 for 3,000 feet	$\frac{1}{2}$ in. inlet and outlet
No. 1,	30.00 for 4,000 feet	$\frac{3}{4}$ in. inlet and outlet
No. 2,	40.00 for 5,000 feet	1 in. inlet and outlet
No. 2 $\frac{1}{2}$ ,	55.00 for 15,000 feet	1 $\frac{1}{4}$ in. inlet and outlet
No. 3,	75.00 for 30,000 feet	1 $\frac{1}{2}$ in. inlet and outlet
No. 4,	100.00 for 40,000 feet	2 in. inlet and outlet
No. 5,	125.00 for 60,000 feet	3 in. inlet and outlet



# FOSTER ENGINEERING CO.

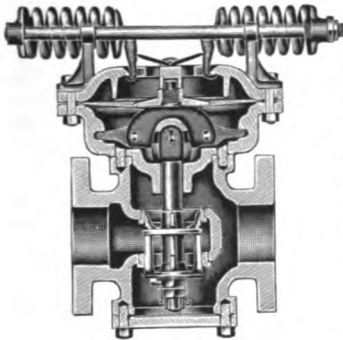
NEWARK, N. J.

BRANCH OFFICES: CHICAGO, PHILADELPHIA, BOSTON, PITTSBURGH

Manufacturing Engineers of Automatic Valve Specialties

**PRODUCTS:** PRESSURE REGULATORS (Reducing Valves), PUMP GOVERNORS (different styles for different purposes), for steam, water, gas and air. HYDRAULIC REGULATING and RELIEF VALVES, for high and low pressures. AUTOMATIC FREE EXHAUST or RELIEF VALVES; BACK PRESSURE VALVES; FAN ENGINE REGULATORS, for controlling speed of fan by pressure in boiler. LEVER BALANCED VALVES; FLOAT VALVES, auxiliary-operated and direct-connected. AUTOMATIC NON-RETURN STOP VALVES; AUTOMATIC NON-RETURN EMERGENCY STOP VALVES, for saturated and superheated steam—semi-steel and cast-steel bodies, and other kindred devices. Over 60 different styles. Also design valves for special services.

## FOSTER PRESSURE REGULATOR—CLASS "W"



For Maintaining a Constant Uniform Delivery Pressure from a Higher Initial Regardless of Variations in the Boiler Pressure or Source of Supply. For Service on Steam, Water, Gas and Air.

Its "compensating spring and toggle lever arrangement" makes it phenomenally sensitive, accurate and reliable. Has no weights, levers, or close-fitting piston or parts to cause friction. Very simple in construction and adjustment. Made in sizes  $\frac{1}{2}$ -inch to 1-inch of composition, larger sizes, iron body, composition mounted. Sizes  $2\frac{1}{2}$ -inch and up are fitted with *renewable seats*, forged steel stem and levers—insuring durability and minimum repairs. Thousands are in use today in all civilized countries and is the "standard" of many large power and manufacturing plants.

121

## FOSTER CLASS "G" PRESSURE REGULATING VALVE

### FOR INTERMITTENT SERVICE

A decided innovation, so extremely sensitive and withal so reliable that delivery pressure may be adjusted from zero to within a fraction of the initial pressure, and at point of adjustment the delivery will remain constant regardless of variation in initial pressure or volume of discharge.

Will operate equally well on horizontal or vertical pipe; upright, inverted or inclined at any angle.

Although of wide range of operation, no part of this valve is of delicate construction or easily deranged.

Orders should state initial and delivery pressures, connections, service and approximate volume of discharge. (See below.)

Made in all sizes,  $\frac{1}{2}$ -inch to 12-inch. Sizes 2-inch and smaller of composition only. Larger sizes, iron body, composition trimmed. Screwed and flanged connections. Also make larger sizes in composition on order only.

Prices on application. Write for General Catalogue No. 30.



### ORDERS FOR PRESSURE REGULATING VALVES SHOULD SPECIFY:

1. Initial or boiler pressure.
2. Maximum and minimum delivery pressure.
3. Connections—screwed or flanged ends, giving diameter.
4. Sizes of both pipes leading to and from regulator.
5. Device or system to which it is to be applied.
6. For high or low pressure service.
7. Size of valve preferred and if we will be permitted to send a smaller size if we deem a smaller valve will give better results. By following our suggestions we often save considerable money for our users.
8. Any additional information towards an intelligent understanding of your requirements will insure your receiving a valve best suited to meet conditions.

# THE LESLIE COMPANY

LYNDHURST, N. J.

Founders and Manufacturers

PRODUCTS: "LESLIE" Patent Pressure Regulator, Patent Removable Coupling Nuts and Sleeves, Bronze and Composition Castings, Engineering Specialties, High Pressure Steam Fittings, Etc.

## THE "LESLIE" PATENT PRESSURE REGULATOR For Steam or Air

**Class "E," Bronze.**—The "LESLIE" Pressure Regulator, Class "E," is especially designed to deliver any desired pressure from a minimum of about ten pounds up to a maximum of 85 per cent. of the initial or boiler pressure up to 350 pounds per square inch, for all kinds of service, both in Marine and Stationary Service, including Saturated or Superheated Steam, Compressed Air and Oil under pressure to Burners, Journal Bearings, etc.

All "LESLIE" Pressure Regulators, Class "E," are made in standard sizes from  $\frac{1}{2}$  inch to 20 inch, inclusive, and are made exclusively of our special high pressure Steam Bronze throughout, except Springs, Bolts, Nuts and Capscrews. The Springs are made of a special steel and are made exclusively for the "LESLIE" Pressure Regulators, and are then specially nickel plated.

Our Class "E" Regulators have met the most exacting and searching tests up to 500 pounds Hydrostatic, and 350 pounds working Steam Pressure, exacted by the United States and Foreign Navies, and in service where all other makes had failed they have proven so successful that they are specified by the leading Naval Architects, Marine Engineers and Mechanical Engineers, as well as the largest users of Reducing Valves in the world, who not only specify them, but insist upon "LESLIE" Valves being installed.

**Class "F," Iron Body.**—Our Class "F" Regulators are designed for Stationary Service where Superheated Steam is not used and where the initial or boiler pressure does not exceed 200 pounds per square inch, and the reduced pressure to be delivered is not less than 10 pounds per square inch.

Similar in design to Class "E," except that it has a Bronze Liner in Cylinder and Bronze Main Valve Seat in Body, and is especially adapted to meet the growing demand for a reliable Reducing Valve in the Stationary Service. The Main Body, Top and Bottom Caps are made of a special high grade Cast Iron, all other parts of high pressure Steam Bronze, same as used in Class "E" Regulators, and are made in standard sizes from 4" to 20", inclusive.

Our Class "F" (Iron Body) Regulators can be found in the largest and most important Power and Steam Plants, Mills, Manufacturing and Mining Plants in this and foreign countries, where they have given results so satisfactory, that we guarantee them to do the work, for which they are intended, satisfactorily to our customers.

**Class "H," Steam Heat Service.**—Our Class "H" Regulators are designed for Steam Heat Service in Buildings, Compressed Air, Oil under pressure, etc., where the reduced pressure to be delivered is not less than 2 pounds nor more than 10 pounds per square inch.

Made in standard sizes from  $\frac{3}{4}$ " to 10", inclusive, from  $\frac{3}{4}$ " to 5", inclusive, they are made of the highest grade high pressure steam bronze throughout.

Above 5" they are made of a special high grade Cast Iron with Bronze fittings.

PACIFIC COAST AGENTS

Charles C. Moore & Company, Engineers

San Francisco, Cal.

# IDEAL AUTOMATIC GOVERNOR CO.

Incorporated

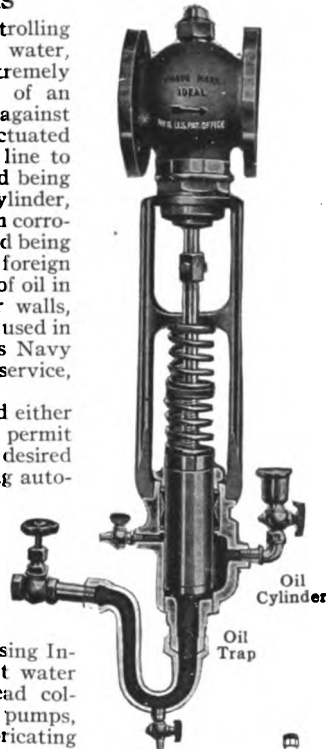
164 EMMET ST., NEWARK, N. J.

**Manufacturers of Pump Governors, Pressure Regulating and Controlling Valves and Ideal Automatic Piston and Valve Rod Packing**

## "IDEAL" AUTOMATIC GOVERNORS

are oil-controlled, piston-actuated, pressure-controlling valves for governing pumps for salt and fresh water, oil, ammonia, air, gas, etc. They are extremely sensitive, with the patented exclusive feature of an oil body in the hydraulic pressure cylinder, against the lower head of the hydraulic-pressure-actuated piston which operates the valve in the power line to the pump. This body of oil prevents the liquid being pumped from reaching the hydraulic pressure cylinder, and thus prevents any sticking of the piston from corrosion or on account of grit or sediment in the liquid being pumped. An oil trap provides for settling of foreign matter, etc., and for retaining a sufficient body of oil in the cylinder to constantly bathe the cylinder walls, piston, and packing in lubricant. The material used in constructing governors for high duty service is Navy composition bronze or steel; for less exacting service, steam composition or cast iron.

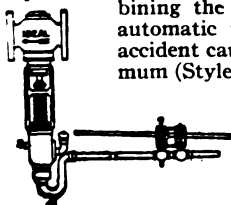
"Ideal" Automatic Governors are constructed either to maintain a constant pressure (Style A), or to permit of variation of the pressure maintained as desired (Styles B, B-1, B-2) and are used for controlling automatic fire sprinkling system pumps, elevator pumps, turbine step bearing pumps, hydraulic pumps, ammonia, gas and air compressors, and any other apparatus requiring sensitive, reliable automatic pressure control of steam, water or pneumatic power. They have been approved and adopted by the United States Navy and by the National Board of Supervising Inspectors of Steam Vessels, for controlling salt water fire pumps, salt water sanitary pumps, bulkhead collision door pumps, fresh water pumps, clutch pumps, hydraulic pumps, ash pumps, forced feed lubricating pumps, ammonia and air compressors, etc.



123



Style C-S



Style A-R

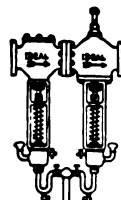
Special adaptations of the "Ideal" Automatic Governor have been made for a variety of purposes, including a stop valve for cutting off flow from pump when pressure falls, or vacuum is broken, by a break in delivery or suction line (Style C-S); a high pressure by-pass relief valve taking pressure from accumulator side and by-passing when full travel of accumulator is reached, or by-passing to atmosphere when electrically pumped liquids exceed maximum desired pressure (Style A-R); a double-safety, combining the principles of Styles A and C-S, providing automatic pressure control, and stopping pump if accident causes the pressure to fall below a fixed minimum (Style A-C-S); and many others.

*Write for descriptive bulletins, showing all styles, and supply data regarding desired sizes, pressure to be controlled, purpose, etc., for prices.*

STYLE "A"



Style B-1



Style A C-S

## AMERICAN STEAM GAUGE & VALVE MANUFACTURING CO.

FACTORY AND GENERAL OFFICES, BOSTON, MASS.

SALES OFFICES: NEW YORK, CHICAGO, ATLANTA, PITTSBURGH

Manufacturers of Steam Traps, Gauges, Valves, Indicators, and Kindred Appliances for Governing, Indicating, Measuring, Recording and Controlling Steam, Water, Air, Gas, Oil, Ammonia, and All Other Pressures



Bourdon Gauge

**AMERICAN GAUGES** are the simplest in construction, yet so designed that maximum efficiency with longest service is assured to the user. Gauges are too often judged or selected from superficial inspection only, with little or no attention to interior construction—the vital part. In American Gauges only the best material and workmanship will be found, as well as accuracy. This means dollars in every sense of the word to the owner, in both operating and maintenance expense. We furnish gauges for every purpose, and especially invite inquiries for installations

where operating conditions are unusually severe. Estimates promptly furnished.

### AMERICAN RECORDING GAUGES

The economical operation of power is safely guarded by the use of accurate, durable Recording Gauges. American Recorders are constructed in the same reliable, workmanlike manner that is characteristic of all our products. The style of case is the same as our non-recording instruments, thus giving uniformity to gauge board installations. Highest grade clock movements are used, insuring accurate time records. Standard chart 8 inch, 24 hour. Special charts to order. Each gauge fitted with our improved fountain pen requiring filling monthly. We specialize in engine room gauge boards complete, and invite inquiry.



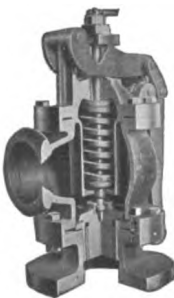
Recording Gauge

### AMERICAN SPECIAL POP SAFETY VALVE

This valve is designed embodying the best features found in our experience during the thirty years of spring loaded safety valve existence. Constructed of the highest grade materials, tested under actual working conditions, simple, efficient, and of few working parts, all being easily accessible, and *all* adjustments made from *outside* valve casing. It is the best in valve construction.

This valve is also made in outside spring pattern for superheated steam.

*Our sixty-five years record is behind our guarantee covering all goods which we manufacture.*



Sectional View

# AMERICAN STEAM GAUGE & VALVE MANUFACTURING CO.

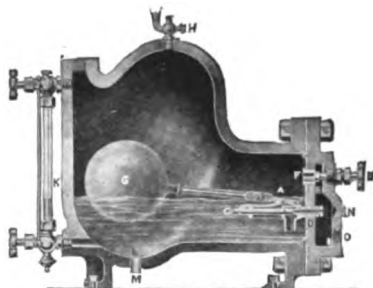
**Established 1851**

FACTORY AND GENERAL OFFICES, BOSTON, MASS.

## AMERICAN IDEAL STEAM TRAP

The essential feature of this Trap is its valve leverage, which is many times more powerful than in any other Float Trap. This permits the use of floats sufficiently heavy to prevent possibility of collapse, and we make positive guarantee to this effect when traps are used on pressures for which they are intended.

The features of construction of this trap, both as regards valve leverage and design of shell or casing, insure unusually low upkeep or maintenance, and absence of trouble in operation.



### Model C—Sectional View

## AMERICAN RELIEF VALVES

### Iron Body Brass Mounted

## All Brass



**Approved Underwriter**



### Standard



### For Small Pumps

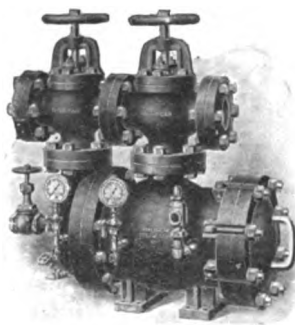


### For Tanks, Etc.

## AMERICAN H<sub>2</sub>O GREASE EXTRACTING FEED-WATER FILTER

Designed for the efficient removal from feed water of grease which, after slight boiling, adheres in the form of "slugs" to boiler shell and flues. This filter has a filtering surface many times greater than area of the feed-water pipes, and occupies small space.

**OPERATION**—Under double filtration, filtering cages are covered with two layers of "Turkish toweling," which cloths are to be changed as often as conditions require. Temporary cleaning, however, may be effected by applying a reverse current of steam and drawing off the oil and grease while filter is in service. See illustration. Further particulars sent on request.

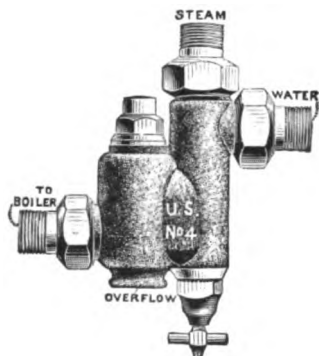


### Grease Extracting Feed-Water Filter

## AMERICAN INJECTOR COMPANY

DETROIT, MICH.

Manufacturers of Injectors, Ejectors, Jet Pumps, Drive Well Jet Pumps, Exhaust Injectors, Fire Plugs, Grease Cups, Oil Cups, Oil Pumps, Water Gauges, Air Cocks, Gauge Cocks, Lubricating Devices and Other Steam Specialties



U. S. Automatic Injector—Regular Style

**Other Distinctive Features are:** 1. The Drip-Cock. 2. The construction of disk valve on delivery tube, which, being cup shaped, is forced to rise to its seat by the jets of water thrown against it from beneath. 3. The overflow valve, which never wears leaky.

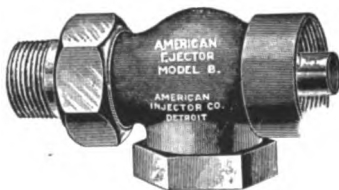
Sizes range from  $\frac{1}{4}$ "-3" Pipe Connection, with corresponding capacities of 36 to 5800 lbs. per hour at 80 lbs. steam pressure and three foot lift, water 76 deg.

Special High Steam Injectors to work to 300 lbs. steam pressure can be furnished to order. Also, injectors with special connections.

### AMERICAN EJECTORS (Model B)

The American Ejector, because of its internal construction, gives superior service in raising water from deep wells, mines and pits or emptying tanks, raising and transferring liquids (hot or cold) in tanneries, dye houses, etc., or for priming centrifugal pumps.

The jets are made of a special hard bronze and can be renewed when worn, as the body of the Ejector will last indefinitely.



American Ejector—Model B

### GAS ENGINE "EXPLOSO" OIL CUP

"Exploso" Gas Engine Oil Cup is especially designed and manufactured for the class of work demanding a Lubricator of the highest type.

The filling arrangement consists of a sliding lid which makes the filling of the cup very simple and insures it being oil tight. The sight feed opening is large and the shank is fitted with a large ball check valve to prevent back pressure entering the sight feed chamber. A baffle cap is also used which effectually muffles and diffuses any gas that may escape past the ball. With these improved features an even, constant flow of oil to the cylinder is insured.

The rate of feed can be adjusted by the milled regulating screw and ratchet holding same to place.

Catalogue No. 28 giving full details about U. S. Automatic Injectors and "The Engineers' Red Book," full of practical information for the Operating Engineer, will be promptly sent upon request.



## PENBERTHY INJECTOR CO.

DETROIT, MICH.

N. Y. OFFICE  
71 BEEKMAN ST.

LONDON, ENGLAND

BRANCHES:

HANOVER, GERMANY

CANADIAN PLANT  
WINDSOR, ONT.

PARIS, FRANCE

**Manufacturers of Injectors, Ejectors, Valves, Cellar Drainers, Steam Specialties, Lubricating Devices and Carburetors**



Automatic Injector

### AUTOMATIC INJECTORS

Nearly a Million in Use

All our claims for the "Penberthy" Injector are based on actual tests, as we have set for this machine a very high standard, which for years has been steadily advanced, and the "Penberthy" to-day is better than ever before. Every "Penberthy" Injector is carefully tested before leaving the factory, and no machine is allowed to go out that will not work on the following points, while nearly all of them will do much better.

*Start Low,* 20 to 22 lbs. steam on 3-foot lift.  
*Work High,* 165 to 170 lbs. steam on 3-foot lift.  
*Lift Water,* 20 to 24 feet on 60 to 80 lbs. steam.  
*Handles Hot Water,*  
125° to 130° at 60 to 80 lbs. steam.  
115° to 120° at 100 lbs. steam.  
95° to 104° at 125 lbs. steam.

Special Injectors furnished where conditions are unusual.

### XL-96 EJECTOR SIPHON OR STEAM JET PUMP

It would be difficult to enumerate all the uses to which our jet pump is adapted, but when we say that **anything and everything** in the nature of a liquid (if not too thick) can be transported from one level to another, or horizontally almost any distance, we have about covered the ground; therefore the following factories, mills, etc., will see the advantage of adopting them, viz.: Chemical Works, Creameries, Cheese Factories, Tanneries, Mines, Well Diggers, Brickyards, Gas Works, Paper Mills, Steamboats, Breweries, Distilleries, etc.



XL-96 Ejector

### SAFEGUARD AUTOMATIC WATER GAGE

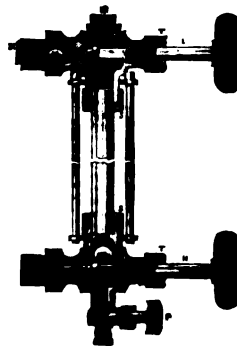
Operates on any pressure from 2 pounds up.

Is Tested to 300 pounds and given a thorough examination before being sent out.

Is Constructed simple and strong. There are no springs or levers to get out of adjustment, no unnecessary parts or complications.

Is Self-Cleaning by the action of the blow-off vibrating the balls. The cleaning stem in lower shank goes all the way through into the boiler, absolutely preventing opening from ever being closed by scale, etc. All dirt, deposit, and sediment is forced out through pet-cock each time glass is blown.

Has Patent Dripless Pet-Cock which, when closed, is absolutely tight. The dripless pet-cock is a patented Penberthy feature and is found on no other gage.



Safeguard  
Automatic Water Gage

*Send for complete Catalog. Our Engineering Department is at your service.*

## AMERICAN DISTRICT STEAM CO.

GENERAL OFFICES AND WORKS

NORTH TONAWANDA, N. Y.

NEW YORK

CHICAGO

SEATTLE

Engineers and Contractors; "Central Station Heating;" Steam Specialties

### CENTRAL STATION HEATING SYSTEMS

Hundreds of Electric Light and Power Companies are selling their EXHAUST STEAM during nine months of the year for heating stores, offices, public buildings, schools, churches, residences, etc.

We will gladly send our representative to investigate *your* conditions and make report.

**LIST OF PUBLICATIONS:** The following list of publications has been issued by this company upon various phases of central station heating:

Our illustrated pamphlet "Central Station Heating" describes in detail the most desirable public utility—Steam Heat.

128

- No. 113—Standard steam pipe casing and wood pipe.
- No. 114—Condensation and pressure meters.
- No. 115—The financial effect of combining an exhaust steam heating system with an electric light and power plant.
- No. 116—The advantages of central station heating to electric companies.
- No. 117—Steam heating in connection with central stations.
- No. 120—Some of the factors that affect the cost of generating and distributing steam for heating.
- No. 121—The developing and application of central station heating.
- No. 122—District heating plants.
- No. 123—Central station heating in Birmingham, Ala.
- No. 124—The value of district steam heating as a public utility.
- No. 125—Central station heating or conserving the heat unit.
- No. 126—Confessions of an engineer.
- No. 128—Central station heating from a commercial standpoint.
- No. 129—Efficiency of underground steam main construction.
- No. 130—The simplex condensation meter.
- No. 131—Central station heating in the smaller cities.
- No. 133—The atmospheric system of steam heating.
- No. 140—Steam heat from a central station. Its use and misuse.
- No. 141—The commercial value of exhaust steam.
- No. 142—How to figure radiation required in a building.
- No. 143—Some phases of central station heating in connection with public utilities.
- No. 144—Sliding Scale Rates for Central Station Heating Service.
- No. 146—St. John Indicating and Recording Steam Flow Meter (straight-way type).

### STEAM SPECIALTIES

Comprising a complete line of materials for underground steam main construction, also meters, steam traps, regulators, heaters, valves, separators, flanged fittings, and "ADSCO" Specialties for the Atmospheric System of Steam Heating.

*Write to-day for our bulletins.—They are free.*



# THE DOLE VALVE CO.

208 N. FIFTH AVE., CHICAGO, ILL.

Manufacturers of Packless Radiator Valves & Double Compression Couplings

## DOLE PACKLESS GRADUATED VALVE

The Ideal Valve for Vacuum or Vapor Steam Heating

The Dole Graduated or Modulating Valve is as carefully built as a watch—and as easily understood. Placed at the top of the radiator—where it is easily accessible without stooping—any degree of heat can be obtained with less than a half turn of the handle. Besides being the best-looking modulating valve, the Dole is the best constructed. Its packless feature—which has proved its utter practicability in over 250,000 installations—guarantees against leakage.

A short study of the sectional view shown will prove that in designing the Dole Packless Graduated Valve we have mastered all requirements necessary to make a perfect working Graduated or Modulating Valve.

### Highly Finished

The Dole Modulating Valve is heavily nickeled and will retain its bright, handsome appearance indefinitely. Its exceptionally low height prevents it from protruding above the radiator.

### Packless

A feature which has made the Dole a permanently leakless valve. Overcomes the "packing-in-the-stuffing-box" method of construction which has caused endless trouble and damage by its leakiness.

Should any adjustment be desired *after* the valve is fitted and installed, all that is necessary is simply to loosen octagon nut on top of dial with special wrench, which is furnished for the purpose, turn dial to left to the desired point, then tighten nut. This adjustment is easily made *while the steam is on*.

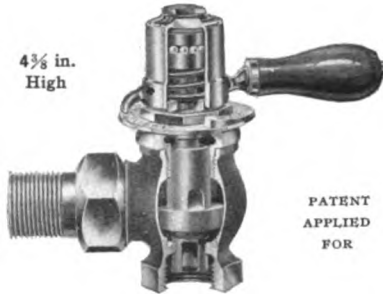
Made in  $\frac{1}{2}$ ",  $\frac{3}{4}$ ", 1",  $1\frac{1}{4}$ ",  $1\frac{1}{2}$ " and 2" sizes.

## DOLE PACKLESS RADIATOR VALVES

Dole Packless Radiator Valves are made in Angle, Right-Hand Corner, Left-Hand Corner, Straight-way Globe, and Straight-way Gate Styles.

The sectional cut shown illustrates clearly the quick-opening feature, the double spiral thread, the one-piece rotating stem of properly proportioned size, and the manner in which the stuffing box of the ordinary valve has been eliminated.

Over 500,000 Dole Packless Radiator Valves are now in actual service.



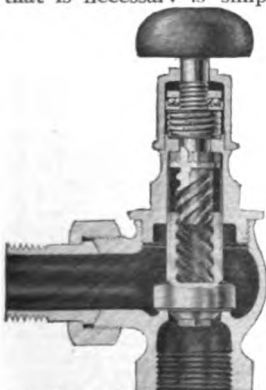
Dole Graduated Valve (Sectional View)

### Durably Constructed

The Dole Valve is designed for practically everlasting service. The casting is of the best steam bronze—every detail carefully machined. The handle is made of selected mahogany.

### Ball-Bearing

An exclusive feature. No matter how long the valve has been unused it can never stick or bind. When closed it shuts off absolutely tight.



Dole Angle Valve (Sectional View)

Send for our Catalogue

# CENTRAL FOUNDRY COMPANY

90 WEST STREET, NEW YORK

CHICAGO

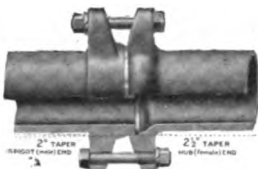
ATLANTA

SAN FRANCISCO

DALLAS

Manufacturers of Universal Pipe, Soil Pipe, F. &amp; W. Fittings, General Castings

## UNIVERSAL PIPE



Sectional View of "Joint"  
Showing Machined Universal  
Joint with Bolts in Position  
through Ends

Universal Pipe is cast iron pipe with hub and spigot ends, the contact surfaces of which are machined on a taper giving a natural iron to iron joint, which is permanently tight. By making the tapers of slightly different pitch the joint provides for expansion and contraction, vibration and uneven ground settlement.



TRADE  
MARK

The lengths of pipe are drawn together by bolts, two bolts to a joint sufficing except for pressures above 175 pounds in some sizes. The pipe can therefore be laid at a slight labor cost, and without

calking. No molten lead, oakum, etc., required. No equipment, except two wrenches.

The iron to iron contact of the Universal Joint eliminates electrolysis. The result is a pipe that *does not leak, and continues not to leak*, with a joint that, as long as cast iron lasts, will remain tight under pressures even up to 500 pounds.

**High Pressure Service:** Universal Pipe is especially adapted to high pressure service, and particularly for high pressure fire lines. There is no packing to blow out, and nothing to deteriorate.

**Subaqueous Work:** Lines running under rivers or under water work of any kind are easily and economically laid by the use of Universal Pipe. In shallow water the joints can be made up under water if convenient.

**Gas Systems:** Universal Pipe is particularly advantageous in high and low pressure gas lines, by reason of the tight joint under differences of temperature and its freedom from electrolysis. The close contact of the smooth machined hub and spigot ends makes a joint through which gas cannot escape.

**Curved Lines:** Straight lengths of Universal Pipe may be laid on a curve of 150 feet radius.

## SPECIFICATIONS

Nominal Inside Diameter	Class No. 100 100 Lbs. Pressure			Class No. 130 130 Lbs. Pressure			Class No. 175 175 Lbs. Pressure			Class No. 250 250 Lbs. Pressure			Bolt Sizes
	Approx. Thickness Inches	Estimated Weight Pounds per		Approx. Thickness Inches	Estimated Weight Pounds per		Approx. Thickness Inches	Estimated Weight Pounds per		Approx. Thickness Inches	Estimated Weight Pounds per		
		Foot	6-Ft. L'gth		Foot	6-Ft. L'gth		Foot	6-Ft. L'gth		Foot	6-Ft. L'gth	
2	..	..	..	..	..	..	.35	8 1/2	51	.39	9 1/2	57	1/2 x 3 3/4
3	..	..	..	..	..	..	.37	13	78	.42	14 1/2	87	1/2 x 4 1/2
4	.37	18	108	.40	18 1/2	112 1/2	.43	20 1/4	121 1/2	.45	21 1/4	127 1/2	5/8 x 5 1/2
5	.40	24	144	.425	25	150	.45	26	156	.49	29	174	5/8 x 5 1/2
6	.43	30	180	.45	31	186	.47	32	192	.51	35 1/2	213	3/4 x 6
8	.47	44 1/2	265 1/2	.49	46	276	.525	49 1/2	295 1/2	.58	53 1/4	319 1/2	7/8 x 6 1/2
10	.50	60 1/2	363	.53	63 1/2	381	.58	67 3/4	406 1/2	.64	74	444	1 x 7 1/2
12	.53	75 1/2	453	.57	80 1/2	483	.62	87	522	.70	97 1/2	585	1 x 8
14	.565	94 1/2	567	.60	99 1/2	597	.66	107 1/2	64	.76	124	741	1 1/4 x 9
16	.60	115 1/2	693	.65	123	738	.72	134	804	.83	156	936	1 1/4 x 9 1/2
20	.67	166	996	.73	178	1068	.82	196	1176	.94	223	1338	1 5/8 x 11 1/2

Lengths lay a full six feet. All pipe tested with a minimum hydrostatic pressure of 300 pounds per square inch.

**Special Castings** are made with Universal hub and spigot openings, thus avoiding, except in extreme cases, the use of nipples. The lugs upon special castings are in one plane so that the branches or openings will all be in the same plane.

**Approved by Fire Underwriters:** Universal Pipe and Fittings have been tested and approved for fire protection service by the Underwriters' Laboratories which are under the direction of the National Board of Fire Underwriters.



U-165

## **MALLEABLE IRON FITTINGS CO.**

INCORPORATED 1884

BRANFORD, CONN.

**Manufacturers of Malleable Iron Pipe Fittings for Gas, Steam and Water; Steel Fittings for High Pressure Service; Air Furnace Refined Malleable Iron and Semi-Steel Castings; Carbon and Alloy Steel Castings**

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### **EXTRA HEAVY FLANGES**

#### **For High Pressure Requirements**

For Rolled, Shrunk or Welded Connection, bored, countersunk, grooved, faced and drilled to specification.

### **HIGH PRESSURE FITTINGS**

#### **Standard Sizes in Stock in Steel or Malleable**

Machined, tested and ready for the line.

Specials made to order for railroad, manufacturing, mining, and municipal power plants in compliance with Lloyds Rules or Regulations of the U. S. Steam-boat Inspection Service.

### **MALLEABLE IRON AND SEMI-STEEL CASTINGS**

For Machinery; Automobile; Gun; Sewing-Machine; Overhead, Third-Rail, Underground Electrical Construction and all miscellaneous work.

### **LOW CARBON STEEL CASTINGS**

Better than Open Hearth—Equal to Crucible.

### **SPECIAL METAL "A"**

For Gears and Cams where resistance to wear is wanted. May be heat-treated to required hardness.

### **AIR FURNACE REFINED VANADIUM IRON**

For Piston Heads, Piston Rings, and Cylinders. Has a high tensile strength and is tough, sound, and dense.

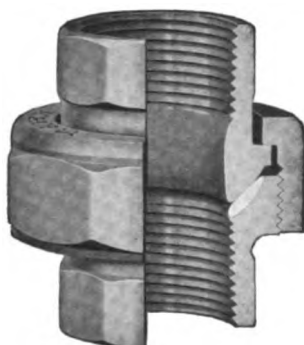
### **CUSTOM AND JOBBING DEPARTMENT**

Galvanizing, Tinning, Japanning, Contract Machining of Malleable Iron, Grey Iron, Wrought Iron, and Steel. Galvanized Nails—Marine Hardware.

# MARK MANUFACTURING CO.

P. O. Box G, CHICAGO, ILL.

Makers of Wrought Pipe and Couplings, Boiler Tubes, Electric Wire Conduit, Well Casing, Well Points, Pump and Well Cylinders, Well Strainers, Well Valves and Tools, Pipe Cutters, Vises, Threading Dies, and Pump and Well Supplies



## THE MARK COLD DRAWN STEEL PIPE UNION

Leakless — Rustless — Different

Cold drawn from rolled steel, the logical material for fittings used on steel Pipe.

It will not leak, break or corrode—*BECAUSE*:

1. It will expand and contract in *exactly the same degree* as steel pipe with which it is used, consequently it is not subject to leakage at threads, which is unavoidable where malleable and brass unions are used with steel pipe.

2. It is entirely free from blow holes and sand holes, defects common to all types of unions made of malleable iron and cast brass.

3. It has a steel-to-brass seat, the brass ring being actually welded to the steel in which it is embedded.

4. The threads are accurately cut, and have the same taper as the pipe.

5. It is designed to carry high pressure as well as low, and all sizes are equally strong.

6. All surfaces, including all the threads, are rust-proofed. Therefore, the Mark Union will not rust or freeze to the Pipe.

### SIZES AND LIST PRICES

Pipe Size	$\frac{1}{8}$ "	$\frac{1}{4}$ "	$\frac{3}{8}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	$1\frac{1}{4}$ "	$1\frac{1}{2}$ "	2"
	.30	.30	.40	.50	.60	.80	1.20	1.60	2.00

# H. W. JOHNS-MANVILLE CO.

NEW YORK CITY

Branches in 55 Large Cities

Asbestos and Magnesia Products

Power Plant Specialties

## JOHNS-MANVILLE SERVICE TO POWER PLANTS

From the buying angle, the value of Johns-Manville Service to you lies in its wide scope and great variety of products, touching nearly every phase of your work. It means not only a convenience in purchasing, but a centralization of responsibility—for Johns-Manville backs up each product to assure your satisfaction.

If you are not acquainted with this aid to buying, you're missing something worth while. In the interests of your plant, let's get together.

## JOHNS-MANVILLE POWER PLANT PRODUCTS

### Heat and Cold Insulations

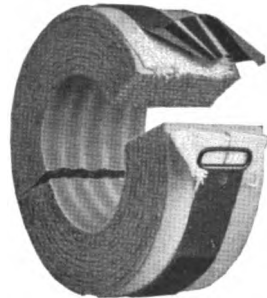
Asbesto-Sponge Felted Pipe Covering.  
Asbestocel Covering and Sheets.  
85% Magnesia Covering.  
Asbestos Fire-Felt Covering.  
Asbestos Air Cell Covering and Sheets.  
Asbestos Moulded Covering and Blocks.  
Anti-Sweat Covering.  
Aqua Covering.  
Zero Covering.  
Brine and Ammonia Covering.  
Cold Storage Insulation.  
Vitribestos Materials.  
Magnesia Cement and Blocks.  
Sectional Conduit.

### Johns-Manville Power Plant Specialties

Steam Trap.  
Asbestos Brake Blocks.  
High Temperature Cements.

### Johns-Manville Packings

Service Sheet Packing.  
Seigelite Packing Sheets.  
Kearsarge Gaskets.  
Sea Rings.  
Metallic Packing.  
Universal Piston Packing.  
Valve Stem Packing.



Johns-Manville Asbesto-Sponge Felted Pipe Covering  
One of the Johns-Manville line of Pipe Insulations



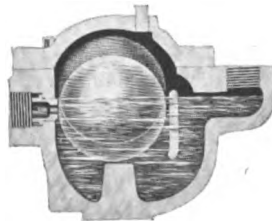
Johns-Manville Sea Rings  
An automatic steam, air and hydraulic packing



Johns-Manville Fire Extinguisher  
Instantly extinguishes any type of incipient blaze

## OTHER JOHNS-MANVILLE PRODUCTS

NOARK Fuses and Electrical Materials.  
Asbestos Roofing and Siding  
Fire Extinguisher.  
Flexible Metallic Steam and Water Hose.



Johns-Manville Steam Trap  
Only three parts—the body, the rolling ball and the discharge bushing—nothing to get out of order

## THE MAGNESIA ASSOCIATION OF AMERICA

702 BULLETIN BUILDING, PHILADELPHIA, PA.

Manufacturers of "85% Magnesia" Insulations

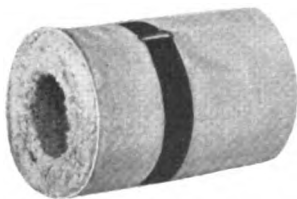
### Objects of the Association

To improve the practice of heat insulation for power-plants and for general heating by disseminating information as to the heat-saving qualities of Magnesia Pipe and Boiler Coverings (known as "85% Magnesia"); and to expertly investigate the problems of correct heat insulation with a view to still further possible improvement in the provision of the most suitable coverings, especially with regard to super-heat and high-pressure steam.

### "85% MAGNESIA" INSULATIONS

#### For Pipes and Boilers

The non-conducting value of "85% Magnesia" coverings for pipes and boilers has been recognized for upwards of a quarter of a century.



Whether for high or low pressure or super-heat, "85% Magnesia" coverings afford the maximum of economic protection against heat-losses, with consequent saving in coal consumption and increased efficiency.

"85% Magnesia" coverings are standard in the U. S. Navy, nearly all railroads and locomotives, the majority of passenger- and cargo-ships, power-plants, central stations, municipal buildings, large office-buildings, department stores, large industrial and manufacturing plants.

### Standard Specification

The standard specification of the Magnesia Association covers every form of application of "85% Magnesia" to pipes, boilers, etc. Based on the most approved practice, it contains valuable data for the guidance of the engineer in every kind of steam service. Sent free on application to the Bureau of Publicity of The Magnesia Association of America, 702 Bulletin Building, Philadelphia, Penna.

### Executive Committee of the Association

WILLIAM A. MACAN, *Chairman*

GEORGE D. CRABBS	The Philip Carey Co.	Cincinnati, Ohio
ALVIN M. EHRET	Ehret Magnesia Mfg. Co.	Valley Forge, Penna.
J. R. SWIFT	The Franklin Mfg. Co.	Franklin, Penna.
R. V. MATTISON, JR.	Keasbey & Mattison Co.	Ambler, Penna.



## A. WYCKOFF & SON CO.

Established 1855

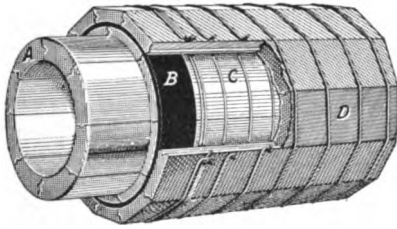
ELMIRA, NEW YORK

Manufacturers of Steam Pipe Covering, Wood Water Pipe

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### WYCKOFF'S IMPROVED STEAM CASING FOR UNDERGROUND OR EXPOSED STEAM LINES

Made of Gulf Cypress, The Wood Eternal



A—2 Inch Thick Inner Shell.  
C—Dead Air Space.

B—Asphaltum Packing.  
D—1 Inch Thick Outer Shell.

135

Gulf Cypress is used instead of Pine or Tamarack because Gulf Cypress is the only known wood not affected by Wet or Dry Conditions. The outer shell is one inch thick, the inner shell two inches and the dead air space  $\frac{1}{4}$  inch, making the total thickness of the casing  $3\frac{1}{4}$  inches. These improvements will more than double the life of former Wyckoff casings. The asphaltum packing and the driven joint make the casing absolutely waterproof.

We make the casing in lengths of from four to eight feet. The lengths are connected by tenon and socket joints. In putting over the pipes it requires simply to be driven together.

This pipe casing is the ONLY ONE on the market with

$\frac{1}{4}$ " DEAD AIR SPACE BETWEEN THE SHELLS.

*Send for our booklet to-day—it tells you all about these improvements.*

# CELITE PRODUCTS COMPANY

NEW YORK  
11 Broadway

CHICAGO  
Monadnock Bldg.

PITTSBURGH  
Oliver Bldg.

LOS ANGELES  
Van Nuys Bldg.

SAN FRANCISCO  
Monadnock Bldg.

Producers of **SIL-O-CEL** for Insulation of Heat and Cold, Fireproofing and Sound Deadening



**SIL-O-CEL Prevents  
Heat Penetration**

**SIL-O-CEL**  
MADE FROM CELITE

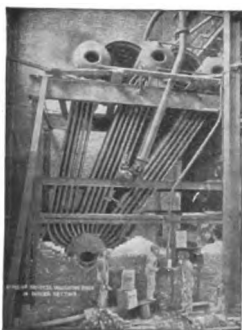
Products in the form of Bricks, Powder and Plastic Cement are prepared from the natural mineral Celite especially for heat insulation. **SIL-O-CEL** is used as a backing for the more highly conductive fire brick. Its insulating value being 10 to 12 times that of ordinary fire brick. It is not subject to decomposition or change at high temperatures, and vibration will not cause it to settle or shrink when properly installed.

**SIL-O-CEL INSULATING BRICK** are used to prevent heat penetration through walls of heated equipment when laid between the fire brick lining and outside red brick wall or shell.

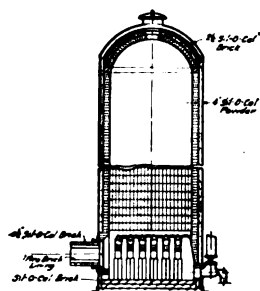


## FOR BOILER SETTINGS

**SIL-O-CEL** in both Brick and Powder form is perfectly adapted as an insulating backing for preventing heat losses through fire brick walls of boiler settings, furnaces, hot blast stoves, bakers' ovens, etc., and for general industrial work. **SIL-O-CEL** Insulation insures increased capacity, more uniform temperature, reduction in fuel and improved working conditions.



**Laying Up SIL-O-CEL Insulating  
Brick in Boiler Setting**



**Hot Blast Stove Insulated  
with SIL-O-CEL Powder**

**SIL-O-CEL** Insulating Products are used extensively for Preventing Heat Losses, increasing the Capacity and Efficiency of

Boiler Settings  
Heat Treating Equip.  
Annealing Furnaces  
Crucible Furnaces  
Electric Furnaces  
Regenerators

Hot Blast Stoves  
Hot Blast Mains  
Bustle Pipes  
Coke Ovens  
Metal Mixers  
Hot Metal Cars

Gas Generators  
Oil Stills  
Core Ovens  
Japanning Ovens  
Kilns, Etc.  
Steam Pipes



# AMERICAN BALANCE VALVE CO.

JERSEY SHORE, PENNA.

**Balanced Valve Specialists**

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Having devoted our entire energies as Balanced Valve Specialists for the past 25 years and in reviewing our experiences, we find them very interesting.

We have made Piston Valves from  $2\frac{1}{2}$ " to 42" in diameter for engines from 5 H. P. to the mighty Battleship engines.

We have also manufactured Slide Valves for the smallest to the largest steam engines.

Having passed through the above valve experiences we also took up the Piston Ring business, which ranges through Automobiles, Air Compressors, Dredges, Steam Shovels, Stationary Engines, Locomotives, and Marine Engines.

We shall be glad to entertain any inquiries covering the above. By controlling our own foundry we are in a position to give prompt deliveries and furnish our own special mixture of Gun Iron Metal.

**WE ARE AT YOUR SERVICE.**

# THE PICKERING GOVERNOR CO.

PORTLAND, CONN.

**Manufacturers of Governors for Steam Engines and Turbines, Gas Engines,  
Mechanical Control and Speed Limit**

## THE PICKERING GOVERNOR

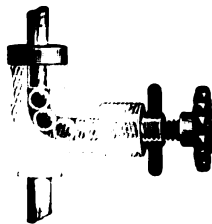
Owing to the absence of joints our Governors are very responsive to slight changes in load, moving quickly and positively into correct position for maintaining the admission of steam proportionate to the duty required of the engine. Absence of joints gives maintenance in efficiency under continued and severe duty.

Greatest range in speed adjustment with close regulation at all points.



Fig. 33

Class B represents Governor with Speed Ranger by use of which the speed of Engine can be varied while in motion. Sawyer's Lever is also included



Detail of the Speed Ranger

All Governors equipped with Wide Range Speed Changer. U. S. & Foreign Patents.



Fig. 34

Class A, to which is added the Automatic Safety Stop. This Stop closes valve when belt breaks or runs off Pulley, and is simple and certain in its action

TABLE OF DIMENSIONS, ETC., FOR CLASSES A AND B

Size of Governor Diameter of Opening	1 1/4	1 1/2	2	2 1/4	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	9	10
From cen. of inlet to base	3 1/4	3 1/2	4 1/4	4 1/2	5 1/4	5 1/2	6 1/4	7 1/4	7 1/2	8	8 1/2	9	10	11 1/2	11 1/2
Extreme Height	20 3/4	23 1/2	25 1/2	27 1/2	27 1/2	32 1/2	33 1/2	41 1/2	41 1/2	46 1/2	49 1/2	49 1/2	53 1/2	55 1/2	60 1/2
Extreme Expan. of Balls	7	8	8	9	9	10	10	13	13	15	16 1/2	16 1/2	18	20	20
Speed of Governor	350	380	380	300	300	340	340	320	320	275	275	275	260	260	225
Dia. of Pulley on Gov'r	2 1/2	3 1/2	3 1/2	4	4	4	4	5	5	5	6	7	7	8	8
Di. of Cyl 300 ft. P'n. Sp.	6	7	9	10	12	14	16	18	20	22	26	31	36	40	45
" " 400 " " " "	5	6	8	9	10	12	14	16	18	20	23	27	31	35	39
" " 500 " " " "	4 1/2	5	7	8	9	10	12	14	16	18	21	24	28	31	35
" " 600 " " " "	4	4 1/2	6	7	8	9	11	13	15	16	19	22	25	28	32

For complete table and for sizes below 1 1/4—see our general catalogue.

We build to meet special conditions whenever practicable and are pleased to submit suggestions on request.



*Pickering is standard for specifications in Steam practice the world over.*

*We offer our services with over fifty years' successful experience.*



# DETROIT LUBRICATOR COMPANY

DETROIT, MICH.

**Manufacturers of Lubricators, Force Feed Oilers, Oil and Grease Cups, Air and Gauge Cocks, Priming Cups, Balanced Throttle Valves, Water Gauges, Pop Safety Valve, Fusible Plugs and Radiator Valves**

## DETROIT SIGHT FEED LUBRICATORS

Detroit Lubricators are made in a sufficient variety of styles and kinds to properly lubricate the valves and cylinders of all types of steam engines, steam pumps, gas engines, air compressors, etc. The complete line includes over 125 styles and sizes of lubricators—one for every kind of service.



Standard Lubricator

## IMPROVED STANDARD LUBRICATOR

Double Connection

For use on all kinds of steam engines, steam pumps, etc.

Installed with both connections between the boiler and the throttle.

Finished in polished brass or nickel plated.

Size.....	$\frac{1}{8}$ Pt.	$\frac{1}{2}$ Pt.	1 Pt.	1 Qt.	$\frac{1}{2}$ Gal.	1 Gal.
Pipe Thread on Support Arm...	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$

## DETROIT FORCE FEED OILERS

Detroit Force Feed Oilers are designed for the mechanical lubrication of gas and gasoline engines, air compressors, etc. The advantages of this system of lubrication are: cool, clean oil forced by mechanical pressure and in quantities as needed to the proper point to be lubricated, the elimination of the possibility of injury from running dry or carbon deposits, and very little attention from the operator as there is only one tank to fill.

They are made with 1 to 28 feeds and corresponding capacities of 3 to 17½ pints, using a standard tank, 4¾" wide and 5" high. Special models for gas tractors, marine and stationary engines, automobiles, commercial trucks and aeronautical motors.



Four Feed Force Feed Oiler

## DETROIT LOCOMOTIVE LUBRICATORS

Detroit Locomotive Lubricators are thoroughly suited to fulfill all the requirements of every style of locomotive from the saturated simple engine to the most modern superheated Mallet. The No. 22 Type of Bullseye Lubricators is recommended as possessing improvements and refinements made desirable by the needs of modern locomotive practice, resulting in a low cost of maintenance and economy in oil. Made with from one to eight feeds.



Three Feed Locomotive Lubricator

## DETROIT RADIATOR VALVES

Detroit Radiator Valves embody in their design the results of years of experience in the manufacture of all kinds of valves for all styles of heating installation. The Detroit Packless Valve fulfills the need for a radiator valve that will not leak around the stem nor need repacking. Its construction makes it perfectly adapted also for use in vacuum systems where tightness is essential.



Packless Valve

## GREENE, TWEED & CO.

109 DUANE ST., NEW YORK

Manufacturers of Rochester Automatic Lubricators, Palmetto and Manhattan Packings, Wrenches, Belt Fasteners, and Other Mill Supply Specialties

### ROCHESTER AUTOMATIC LUBRICATORS

For Use on All Types of Steam Engines and Pumps and Air and Ammonia Compressors

In the new **POSITIVE CLUTCH DRIVE "ROCHESTER"** there are a number of new features which we wish to bring to the attention of all lubricating oil users.

**Positive Clutch Drive:** When we say "positive" we mean "positive," and this statement we are willing to back up by sending out lubricators on trial. Notwithstanding the fact that the drive is a clutch drive, there is a regulating device, whereby can be caused more or less lost motion of the actuating arm.

**Noiseless:** Then in the second place the new "drive" is noiseless, which fact recommends its use in many plants where quiet-running high-speed engines need just such noiseless lubricators.

**Adapted for High Speed:** This new "drive" is just the thing for high-speed engines, one operating at the present time on an engine running at 800 R. P. M. and another having been in operation for over a year on an engine running at 275 R. P. M.

**Working Parts Encased:** The principal working parts, while easily get-at-able, are encased and so protected from dirt, grit, etc.

**Appearance:** The appearance of this new type recommends itself to all users.

**Automatic Gauge Glass Fixture:** If the gauge glass breaks a valve in the lower fixture automatically shuts off the oil and the lubricator keeps on just as though nothing had happened.

**SIZES:** Made in all sizes from one-half pint to two gallons and with any number of feeds from one to eight. Also made with two compartments, for use where different kinds of oil are used in the different cylinders of the same machine, such as air compressors, ice machines, etc.

**Finish**—all sizes fully nickel-plated.

**Working parts** are made of steel, and all bearings are case hardened.

All the mechanism can be almost instantly detached and removed, giving easy access to the working parts for cleaning, repairing, etc., without disturbing the bowl or reservoir attached to the engine.

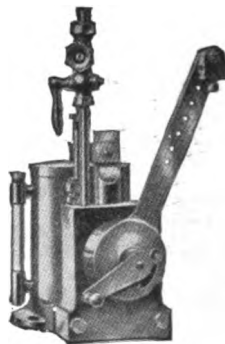
Equipped with Multiplus Sight Feeds, and vacuum and check valves.

Each feed is regulated independently.

Not affected by temperature, pressure, or vacuum.

Can be furnished in the regular ratchet-drive type, if desired.

No expense has been spared in the manufacture of Rochester Automatic Lubricators, efficiency and high quality being our aim rather than low prices.



# McCORD MANUFACTURING CO.

DETROIT, MICHIGAN

NEW YORK OFFICE  
50 Church St.

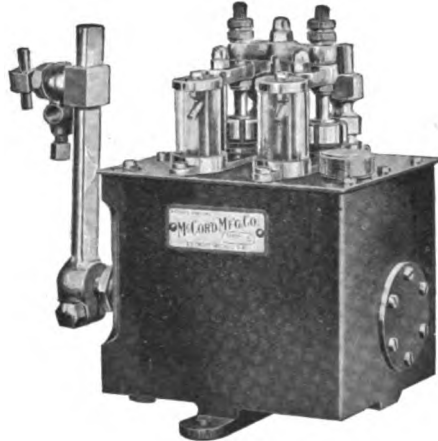
CHICAGO OFFICE  
Peoples Gas Bldg.

Manufacturers of Force Feed Lubricators, Gaskets, Automobile Radiators

## THE "McCORD" FORCE FEED LUBRICATOR

Is made in from 1 to 14 feeds and has a separate pump for each feed. Each pump has individual adjustment. It has constant sight feeds which show exactly how much oil is being pumped to each bearing and the flow can be adjusted from one drop to a full stream per stroke.

It is positive and automatic in action and operates in perfect synchronism with the engine or pump it is lubricating. It is not affected by viscosity of oil, variations in steam pressure or length of feed lines.



Class B—Two Feed

141

Note these standard features *and*  
*Positive sight feeds without pressure*  
*Separate pumps capable of individual adjustment for each feed*  
*Forced delivery of oil against pressure up to 1000 pounds, etc., etc.*

These special features.  
*Heating Chamber*  
*Auxiliary Hand Crank for accelerating feed*  
*Sturdy operating lever*  
*Reversible End Bearing*  
*Plug for draining reservoir*

There is positively no pressure in sight feed; all working parts are of the best drop-forged steel and operate in oil. Rotary or Ratchet drive. Finish—full Nickel Plate or Black Enamel and Brass. Straightaway Spring Check Valves. Heating Chamber and Auxiliary Hand Crank furnished as extras when specified.

### ALL PRICES F. O. B. DETROIT

No.	Capacity	Feeds	List	No.	Capacity	Feeds	List
1	1 Quart	1 Feed	\$25.00	11	1 Gallon	5 Feed	\$57.00
2	1 Quart	2 Feed	30.00	12	1 Gallon	6 Feed	63.00
3	2 Quarts	1 Feed	28.00	13	1½ Gallons	7 Feed	75.00
4	2 Quarts	2 Feed	35.00	14	1½ Gallons	8 Feed	82.00
5	2 Quarts	3 Feed	42.00	15	1½ Gallons	9 Feed	90.00
6	2 Quarts	4 Feed	49.00	16	1½ Gallons	10 Feed	96.00
7	1 Gallon	1 Feed	33.00	17	2 Gallons	11 Feed	108.00
8	1 Gallon	2 Feed	39.00	18	2 Gallons	12 Feed	115.00
9	1 Gallon	3 Feed	45.00	19	2 Gallons	13 Feed	125.00
10	1 Gallon	4 Feed	51.00	20	2 Gallons	14 Feed	135.00

### DOUBLE COMPARTMENT LUBRICATORS FOR AIR COMPRESSORS AND ICE MACHINES

21	2 Quarts	2 Feed	1 Feed in each	\$44.00
22	2 Quarts	3 Feed	2 & 1 Feed in each	50.00
23	2 Quarts	4 Feed	2 Feed in each	57.00
24	1 Gallon	2 Feed	1 Feed in each	47.00
25	1 Gallon	3 Feed	2 & 1 Feed in each	54.00
26	1 Gallon	4 Feed	2 Feed in each	60.00

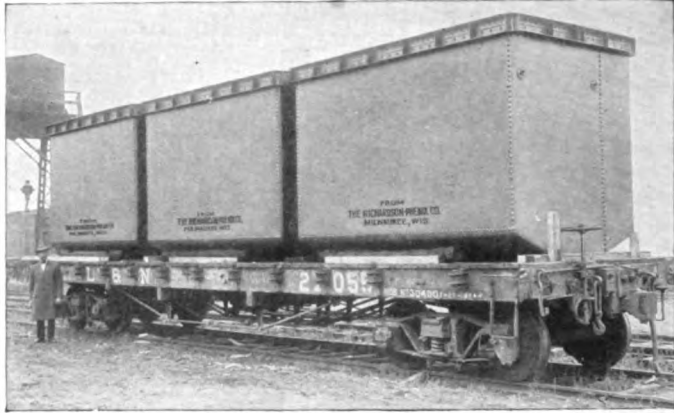
For Heating Chamber add \$1.00 to list. For Auxiliary Crank add \$1.00 to list.  
See Catalog "I" for Details

## THE RICHARDSON-PHENIX CO.

126 RESERVOIR AVE., MILWAUKEE, WIS.

Lubrication Engineers and Manufacturers

### AUTOMATIC OILING AND FILTERING SYSTEMS



These R-P Oil Filters Are Part of a Complete Central Oiling and Filtering System in a Large Central Station. They Continuously Filter 22,500 Gals. of Lubricating Oil Per Hour

142

We have designed and furnished the apparatus for some of the largest oiling and filtering systems ever installed. The same experience we have acquired in designing these large oiling systems is at the disposal of all of our customers, even though they only desire a small filter capable of handling one or two gallons of oil per hour.

We build a complete line of everything for lubrication but the lubricants, and there is hardly a question pertaining to the scientific lubrication of machinery which we have not met and solved.

Our individual oiling and filtering systems can easily be applied to any engine of from 10 to 1500 H. P. Their low first cost, simplicity, efficiency, and reliability make them a desirable addition to any power plant.

Tell us of your lubrication problems and we will be glad to help you solve them. Bulletin No. S 5 describes an exceptionally complete line of filters for purifying lubricating oil.



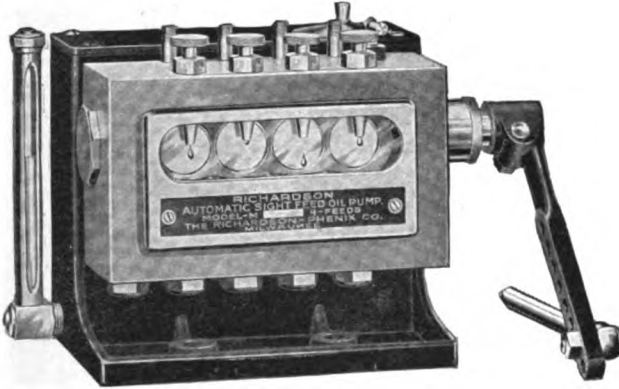
R-P Three Gal. Per Hour Oil Filter

# THE RICHARDSON-PHENIX CO.

126 RESERVOIR AVE., MILWAUKEE, WIS.

Lubrication Engineers and Manufacturers

## MECHANICAL FORCE FEED LUBRICATORS

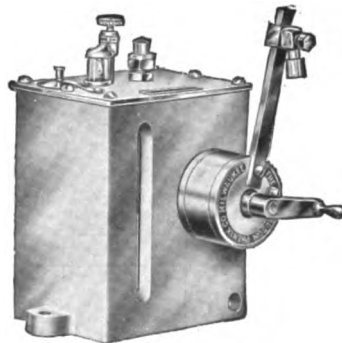


Four-feed Richardson Model "M" Lubricator

143

The Richardson Model "M" Lubricator operates on a new principle in that it supplies oil for cylinder lubrication in small particles for every stroke of the engine piston. The result is better lubrication with reduced oil consumption. Built in sizes from 1 to 22 feeds. It is especially suitable for use on gas, oil, and Diesel engines. Fully described in catalog No. S 60.

The Phenix Model "T" Lubricator is especially suitable for the lubrication of high speed engines, power plant auxiliaries, steam hammers, dredges, traction engines, saw mill steam feeds, etc. Each feed is independently adjustable. It can be regulated and filled while in operation and delivers a definite quantity of any grade of oil against any pressure up to several thousand pounds. Can be furnished in sizes from 1 to 72 feeds. There are a number of superior points of the model "T" which are fully described in bulletin No. S 50.



One-feed, Two-quart Nickel-plated Model "T" Phenix Lubricator

# THE MADISON KIPP LUBRICATOR CO.

Manufacturers of Mechanical Lubricators



These R-P  
Centra



Force Feed Type  
for delivery of feeds

We have  
and filter  
designing  
though  
oil per

We have  
and the  
scientific  
not m

Our  
easily  
H. P.  
and r  
any p

Tell



The Madison Kipp Lubricator has made the force feed system a reality. The Madison Kipp Lubricator Engine builders have selected it as their standard because of its principle and its correct mechanical design. It is the only lubricator in delivery of oil because there are no other lubricators that can force oil against 2000 pounds pressure. The tank operating constantly in oil.

Each unit has sight feed and individual hand crank.

For lubricators - Ratchet or Belt Drive.

Overall Length	Height	Width
12 1/2"	8"	4 1/2"
14 1/2"	"	"
16 1/2"	"	"
18 1/2"	"	"
20 1/2"	"	"
22 1/2"	"	"
24 1/2"	"	"
26 1/2"	"	"
28 1/2"	"	"
30 1/2"	"	"

request



# ALBANY LUBRICATING CO.

ADAM COOK'S SONS, Props.

708-10 WASHINGTON ST., NEW YORK

Manufacturers of Lubricating Oils and Greases

## ALBANY GREASE

Is a pure lubricant so compounded that it automatically maintains a film of oil between rubbing surfaces, reducing friction losses to a minimum. It contains no adulterants and is guaranteed not to oxidize, gum or corrode the metal of the bearings. Made in different consistencies to meet different temperature conditions.

You must consider two things when lubricating machinery of any kind. First—Is the lubricant efficient? Does it give perfect satisfaction at all times or is it a part of the time? Second—Is the lubricant economical? Does it do its work at the lowest price or cost or is it wasteful?

Albany Grease is efficient and economical. It will lubricate any kind of machinery and will not clog.

It can be used in any kind or size of engine and will not clog. It will not corrode, gum or oxidize. It contains no acids. Albany Grease will not clog or gum.

It is economical because it stays where it is put and does not run away. When the machine is not in operation, the grease will flow just enough to give protection. You should bear in mind when buying a lubricant.

Albany Grease will show wonderful results on all kinds of machinery also on Steam, Gas, Gasoline, Oil, and Electric Engines, Pumps, Eccentrics and Shafts. It is used in all kinds of machinery, from Machinery Co. and all kinds of machinery, from Paper Mill Installations and Paper Mill Machinery. It is used in all kinds of machinery, from Paper Mill Machinery and Paper Mill Machinery. It is used in all kinds of machinery, from Paper Mill Machinery and Paper Mill Machinery.

Albany Grease is made in different consistencies to meet different conditions and temperatures. It has been recommended by the best engineers and have absorbed in their work.

SOFT ENGLAND. It is used in all kinds of machinery, from Paper Mill Machinery and Paper Mill Machinery. It is used in all kinds of machinery, from Paper Mill Machinery and Paper Mill Machinery.

MEDIUM. It is used in all kinds of machinery, from Paper Mill Machinery and Paper Mill Machinery. It is used in all kinds of machinery, from Paper Mill Machinery and Paper Mill Machinery.

HARD. It is used in all kinds of machinery, from Paper Mill Machinery and Paper Mill Machinery. It is used in all kinds of machinery, from Paper Mill Machinery and Paper Mill Machinery.

ALBANY GREASE. It is used in all kinds of machinery, from Paper Mill Machinery and Paper Mill Machinery. It is used in all kinds of machinery, from Paper Mill Machinery and Paper Mill Machinery.

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TRADE MARK  
ALBANY LUBRICATING CO.

# MADISON-KIPP LUBRICATOR CO.

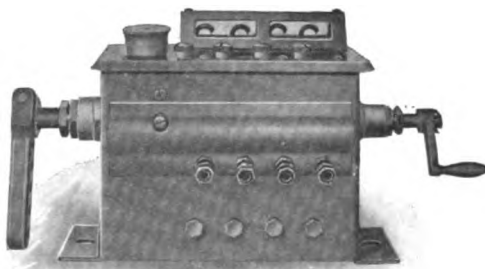
Established in 1898

MADISON, WIS.

Manufacturers of Valveless Force Feed Mechanical Lubricators

*Madison Kipp Lubricators*

STANDARD EQUIPMENT FOR THE FINEST COMPRESSORS,  
STEAM ENGINES, AND OIL ENGINES



**MODEL 50 SIGHT FEED TYPE**

Built in any number of feeds

During the past few years popular demand has made the force feed system of lubrication standard for power installations. The Madison Kipp Lubricator is supplying the bulk of this demand. Engine builders have selected it as their standard because of its Kipp No-Valve principle and its correct mechanical design and construction. It is positive in delivery of oil because there are no ball and spring valves. Each unit is tested to force oil against 2000 pounds pressure. All moving parts are inside the tank operating constantly in oil.

All good features are standard. Each unit has sight feed and individual adjustment. Each lubricator has auxiliary hand crank.

**Data on standard Model 50 Lubricators—Ratchet or Belt Drive.**

	Capacity	Over All Length	Height	Width
One Feed	5 Pints	11 1/4"	8"	4 1/2"
Two Feed	5 1/2 "	12 1/4"	"	"
Three Feed	5 1/2 "	13 1/4"	"	"
Four Feed	6 "	14 1/4"	"	"
Five Feed	6 1/2 "	15 1/4"	"	"
Six Feed	7 "	16 1/4"	"	"

Data on special lubricators and larger sizes furnished on request.

# ALBANY LUBRICATING CO.

ADAM COOK'S SONS, Props.

708-10 WASHINGTON St., NEW YORK

Manufacturers of Lubricating Oils and Greases

## ALBANY GREASE

Is a pure lubricant so compounded that it automatically maintains a film of oil between rubbing surfaces, reducing friction losses to a minimum. It contains no adulterants and is guaranteed not to oxidize, gum or corrode the metal of the bearings. Made in different consistencies to meet different temperature conditions.

You must consider two things when lubricating machinery of any kind. First—Is the lubricant efficient? Does it give perfect satisfaction at all times or only part of the time? Second—Is the lubricant economical? Does it do its work at the lowest possible cost or is it wasteful?

Albany Grease is efficient and economical at all times. It is efficient because it will lubricate any kind of machinery and line shafting perfectly.

It can be used in any kind or style of grease cup and will not gum, cake or clog. It will not corrode, neither will it turn a reddish color, showing that it contains no acids. Albany Grease will remain a golden yellow to the end.

It is economical because it stays where you put it and does not run or leak away. When the machine is not in operation, Albany Grease does not flow. It will flow just enough to give perfect lubrication—no more. These are facts that you should bear in mind when buying a lubricant.

Albany Grease will show wonderful results on Line Shafting and Loose Pulleys, also on Steam, Gas, Gasoline or Oil Engine Main Shaft Bearings, Crank Pins, Eccentrics and Slides. On special machinery, such as Printing Presses, Shoe Machinery, Coal and Metal Mine Equipment, Sugar Machinery, Cotton, Woolen and Paper Mill Installations, Lumber Camp Machinery, Wood Turning, Sawing Machines and in Steel Mills, it gives the best of service. In fact, no matter what kind of machinery you have, Albany Grease will lubricate it so that it will operate perfectly, keeping it cool and easy running, and reducing depreciation to the minimum.

Albany Grease is made in seven different consistencies to meet various conditions and temperatures. Use the right consistency for your work and you will have absolutely no trouble.

**SOFT NUMBERS** (Nos. 0 and 1) for slow running, heavy machinery or where equipment is operated outdoors or low temperature has to be contended with.

**MEDIUM NUMBERS** (Nos. 2 and 3) for general machinery and shafting; the former is known as a winter grease and the latter as a summer grease. These are the most generally used consistencies.

**HARD NUMBERS** (Nos. X, XX, XXX) for use in places where the Soft and Medium numbers are not adaptable, especially where the temperature surrounding the bearings is high. The No. XXX has the highest melting point with a great lubricating value.

Due to the wide publicity given Albany Grease, unscrupulous concerns occasionally substitute inferior goods for our product. When purchasing Albany Grease, insist that our trade mark appears on the package.

We also refine and manufacture in addition to Albany Grease, lubricating oils and greases to meet all requirements. No matter what your lubricating proposition may be, we can supply your entire wants. We will be glad to send complete data covering the entire lubrication of your equipment and place at your disposal expert engineering service.



TRADE MARK  
Reg. U. S. Pat. Office

# THE TEXAS COMPANY

Petroleum and Its Products

HOUSTON

NEW YORK

BOSTON  
ATLANTA  
NORFOLK  
PHILADELPHIA

BRANCH OFFICES  
DALLAS  
YOUNGSTOWN  
BIRMINGHAM

EL PASO  
CHICAGO  
OKLAHOMA CITY

ST LOUIS  
NEW ORLEANS  
DENVER

## TEXACO CRATER COMPOUND

The crying need for an efficient gear lubricant has been felt in many industries for a long time, but this need had never been adequately met before the advent of TEXACO CRATER COMPOUND.

The properties of "CRATER" may be summed up as follows:

1. It adheres to metal surfaces.
2. It is absolutely impervious to mine waters or other chemicals.
3. It is always a lubricant, always oily to the touch.
4. It is pure, homogeneous—as nothing is added to it during manufacture, nothing can separate out in use to destroy its body or to cause it to dry up or flake off.

## OTHER TEXACO LUBRICANTS

In your plant TEXACO LUBRICANTS and TEXACO SERVICE will show the utmost efficiency and economy on engines, dynamos, and machines of all kinds.

The TEXACO Line includes in part:

TEXACO ZENITH VALVE OIL and other cylinder oils, for various steam engine conditions.

TEXACO URSA OIL for the complete lubrication of Diesel Engines, and for all large internal combustion engines.

TEXACO CETUS OIL for turbines of all makes, and for electrical machinery generally. (A zero cold test oil.)

TEXACO NABOB OIL, TEXACO ALEPH OIL, and TEXACO ALTAIR OIL, three very fine general machine oils for light, medium and heavy machines.

TEXACO CANOPUS OIL and TEXACO REGAL OIL, for dynamos and high speed engines and machines.

TEXACO RABTEX SPINDLE OIL and a complete line of oils for the textile trade.

TEXACO CUTTING OILS.

TEXACO GREASES for all purposes.

TEXACO ICE MACHINE LUBRICANTS.

TEXACO MOTOR LUBRICANTS, including Texaco Motor Oil, Texaco Grease, and Texaco Transmission Lubricant, all well known for their high excellence.

TEXACO RAILROAD OILS.

A full line of all the best oils for steam and electric railways, and for all marine purposes.



*We shall be glad, at all times, to take up any question relating to the use or application of lubricants. Address inquiries to The Texas Company, Department M. E., 17 Battery Place, New York City.*

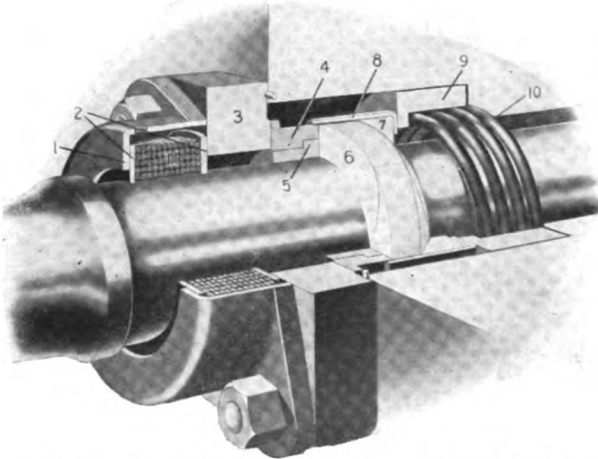


# THE UNITED STATES METALLIC PACKING CO.

FACTORY AND GENERAL OFFICES  
429 N. 13TH ST., PHILADELPHIA, PA.

BRANCH OFFICES: NEW YORK AND CHICAGO

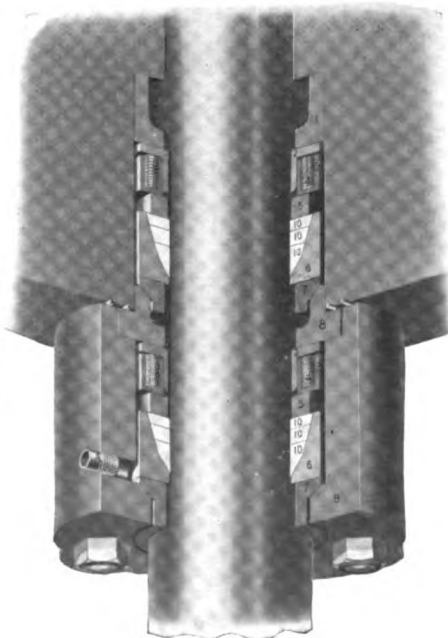
**Manufacturers of Metallic Packings for Locomotive, Marine and Stationary  
Engine Piston Rods and Valve Stems; also other Locomotive Appliances**



King Piston Rod Packing

King Packing for locomotive piston rods, valve stems and air pumps has demonstrated its simplicity, efficiency and economy on a majority of the locomotives in the country. Designed and manufactured in a manner to meet the extreme requirements of modern railway service.

Class No. 1 Packing used in a majority of cases by us for packing marine and stationary engines. We manufacture other designs of metallic packings for marine and stationary service, varying the design to suit the requirements.



Class No. 1 Packing

# JAMES WALKER & CO., LTD.

27 THAMES ST., NEW YORK

AGENTS: J. & R. Wilson, Inc., San Francisco, Calif., Sole Western Agents. Economic Engineering and Supply Co., 47 Clinton Ave., N., Rochester, N. Y. O. C. Keckley, Transportation Building, Chicago, Ill. J. Reynier, Newport News, Va. A. B. Johnson Co., Norfolk, Va.

Manufacturers of Steam and Hydraulic Packings

## "LION" (Patent) EXPANDING METALLIC STEAM PACKING

This Packing is undoubtedly the Ideal Packing for High-pressure Steam Work and high speed engines. As will be seen from the illustration, the packing is made with a channel or groove, and with a corresponding tail, so that each successive turn fits into one another. The packing is automatic in its action, the pressure finding its way into the channel or groove, causing it to expand.



Section of Ring

In work where the rods are worn or not running true, it is the only packing that will keep a perfectly tight gland.

It is made of the finest materials, and by its construction is rendered automatic. As will also be observed, the packing has a metallic wearing face (metal studs) which not only adds to the life of the packing, but at the same time prevents scoring in any way.

We can with confidence recommend it for every description of steam work.

Made in 10- or 12-ft. lengths, all sizes, from  $\frac{1}{4}$  in. upwards, Spiral form.

## "LION" (Patent) AUTOMATIC METALLIC PUMP PACKING

The "Lion" (Patent) Automatic Packing is, without exception, the finest Packing in the market for Hydraulic and Pump-work generally. *Acts like a ram leather*, and by the introduction of metal studs to form a metallic wearing face, friction is absolutely reduced to a minimum. *The pressure acts upon the lip of the packing.*



For your protection, there's a thin red line running through Genuine "Lion" Packing. Be sure to look for it. *Catalog on request.*

# THE B. F. GOODRICH CO.

AKRON, OHIO

Offices in all principal cities

Manufacturers of Mechanical Rubber Goods, Tires, etc.

## HOSE

**WATER HOSE** covers a wide range of usage, making it quite out of the question to advance any specific recommendations as to quality.

"White Anchor," "Akron," and "Commander"—special grades for unusual conditions of service.

"Triton," "Cascade," "Deluge"—regular grades for all general purposes.

"Akron," "Monitor," "Jupiter"—braided fabric water hose—in any length up to 500 feet.

**STEAM HOSE** must be heavily constructed to stand pressure, and inner lining must be so compounded as to resist action of steam under varying temperatures.

"Goodrich"—for high pressure. This is truly a long-life hose.

Special coverings for steam hose: Red Painted Woven Cotton, Marlin Wound, Marlin Woven, Asbestos Wire-Wrapped Cover, or Wire Wrapped.

**PNEUMATIC HOSE**, wrapped duck—50' length style:

"Goodrich"—the highest quality for the hardest service.

"Akron"—the standard hose, for all general purposes.

**Braided Pneumatic Hose**—any length up to 500 feet. "Mainstay" and "Maxecon" brands.

**AIR DRILL HOSE** is heavily constructed throughout with a layer of canvas on the outside as a protection against cuts and abrasions.

"Goodrich"—exceptionally high quality, unequalled for wear.

"Quarry"—our standard grade and biggest seller.

**BOILER WASHOUT HOSE** is made in extra heavy weight to withstand the rough service it encounters. We advocate our heavy "Boiler Washout Hose" for turbine tube cleaner work. "Goodrich," "Akron," "Commander" and "Pinnacle" grades.

**SUCTION HOSE** is made in a variety of grades to suit any purpose, either smooth or rough bore style.

**DREDGING SLEEVES, OIL SUCTION HOSE, OIL WELL DRILLERS' HOSE, OIL CONDUCTING HOSE, GASOLINE HOSE, SAND BLAST HOSE, COKE HOSE, DECK HOSE, Etc.**, all especially adapted to the purposes for which they are made.

## PACKING

**RED SHEET PACKING**—an excellent product, in two grades.

**RED SHEET BRASS WIRE INSERTED** in the same grades.

**DIAPHRAGM AND CLOTH INSERTION:** Packing highly recommended for their proper uses.

**SUPERHEAT PACKING**, a combination of rubber and asbestos, especially adapted for high pressures.

**RED TUBULAR GASKET PACKING, SPIRAL SQUARE DUCK PACKING, ROUND AND SQUARE DUCK PACKING, SQUARE RUBBER BACK ROUND PISTON PACKING, AND PURE GUM STRIPS** all made to supply the demand for these various kinds.

## RUBBER GASKETS

All grades and shapes. No matter what your requirements may be, we can supply them.

## "GOODRICH" RUBBER PUMP VALVES

There is no class of our product which we take greater pride in stamping with the Goodrich trade mark. Our list of grades is complete; we are always glad to give special attention to unusual conditions.

Made in grey or red rubber.

## MOLDED RUBBER GOODS

We have a large department in our factory devoted exclusively to the manufacture of Molded Rubber articles of every description—Diaphragms, Bumpers, Springs, Cushions, Tips, Balls, Billiard Cushions, Respirators, Rubber Mallets, Soles and Heels, Parts for Automobiles, Truck Wheel Tires, Discs for Steam and Radiator Valves, Special Articles used in connection with the Oil Industry, Sugar Factories, Creameries, Breweries, Laundries, Rubber Parts for Plumbing Devices, Carpet Sweepers, Vacuum Cleaners, etc. A large part of this class of our business lies in the direction of strictly special articles made to customers' specifications, to meet individual requirements. Our products are of uniformly good quality and excellent finish.

## THE AMERICAN METAL HOSE CO.

WATERBURY, CONN.

Manufacturers of Flexible Metal Hose and Tubing



Section B. D. 15 Bronze  
Steam Hose Showing  
Interlocking Joints

**AMERICAN METAL HOSE** is just what the name implies—a Hose made of metal.

We manufacture Flexible Metal Hose for all the purposes for which rubber hose is used. Its strength and lasting qualities make it the most efficient and economical hose on the market.

While rubber hose gives fairly good results when used in certain easy services such as carrying air and water, in the more severe duties it is unsatisfactory and expensive on account of the frequent replacements necessary. Rubber is a vegetable compound which rapidly deteriorates under the action of Oils, Alkalis and the intense heat of Steam; consequently no hose with rubber in its composition will last any length of time when used to convey any of these agents.

American Metal Hose is made from a continuous strip of high tensile strength Phosphor Bronze or well-galvanized Steel, the edges of which are turned in during the process of manufacture to make the "Interlocking" joints shown in the accompanying illustration. It has the strength of metal combined with great flexibility, and is in no way affected by the heat of Steam or the chemical action of Oils. In addition to the above advantages Metal Hose will successfully withstand very high pressures. We can supply special Metal Hose for pressures up to 6000 lbs. per square inch.

American Metal Hose of the "Interlocking" construction is, from its very nature, a high pressure hose, and is our standard for conveying Steam and Oils. In addition to this Hose, we are making several other types for carrying Air, Water, Gas, etc., and for Vacuum.

Its permanent nature makes American Metal Hose an admirable substitute for swing or telescoping joints and rigid piping on machines where a flexible connection is desired for conveying Steam or Oil. It is particularly adapted to use on presses where a constant supply of Steam must be fed to the moving parts.

We are prepared to furnish Couplings of any description with our Hose. Prices and full particulars on application.



Government Inspector Testing American Metal Hose for the U. S. Navy Department



**CATALOGUE SECTION**  
**PART II**

**Power Transmission Machinery**  
**Elevating and Conveying Machinery**  
**Hoisting and Transporting**  
**Machinery**

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**Pages 152-232**

## THE A. & F BROWN CO.

Established 1854

Incorporated 1898

79 BARCLAY STREET,  
NEW YORK CITY

WORKS:  
ELIZABETHPORT, N. J.

Engineers, Founders, Machinists and Millwrights. Manufacturers of Gears of all Descriptions, Turned Steel Shafting, Pulleys, Split Pulleys, Friction Clutches, Special Machinery, Etc.

### CUT GEARS

These gears are cut on the best up-to-date automatic machines obtainable, enabling this department of the shops to turn out accurately cut gears of every description and size.

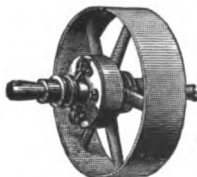
### MACHINE MOULDED GEARS

The Gear Department of our foundry is fitted up with the most modern gear moulding machines, enabling us to furnish machine moulded gears up to 16 feet diameter, and 25 tons in weight if in one piece, and heavier if split, or built up. These gears are much more accurate than ordinary cast gears and are of the toughest mixture of iron.



### FRICTION CLUTCHES

The F. Brown Friction Clutch is simple, compact and having few small parts is not liable to get out of order; engages gradually and when thrown "in gear" has a stronger grip than any other, owing to the large friction surfaces and powerful operating device which is a combination of double-ended (or right and left thread) screw and toggle joint.



### SIRENS

These fog signals are used by the United States Navy and Lighthouse Departments, also by a number of foreign governments and many steamships. They are also in use as fire alarm signals in small towns and large manufacturing plants.

### COGSWELL MILL

The problem of grinding or pulverizing many materials has been successfully solved by this machine.

### SPECIAL MACHINERY

These shops are particularly well equipped for building special machinery to plans and specifications. The pattern shop, foundry and machine shops are strictly up to date in all particulars and equally well equipped to turn out work of the heaviest character as well as light machinery requiring first class material and workmanship and most modern tools.



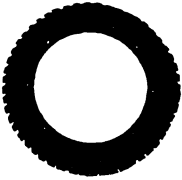
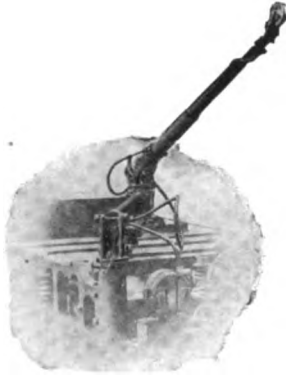
# R. D. NUTTALL COMPANY

PITTSBURGH, PA.

Manufacturers of Cut or Planed Gears of Every Description

## MACHINE CUT GEARS—COUPLINGS—TROLLEYS

For Every Known Railway, Mining and Industrial Application



**Railway Motor Gears  
Haulage Locomotive  
Gears and  
Forged Steel Pinions**

**Forged Steel Gears and Pinions  
Heat Treatment for Every Service**



### Industrial Gears

Spurs	up to 60 feet
Bevels	20 feet
Spirals	6 feet
Herringbone	30 feet
Worm Gears	12 feet
Internals	30 feet



**Trolleys and Flexible Couplings for Any Service**

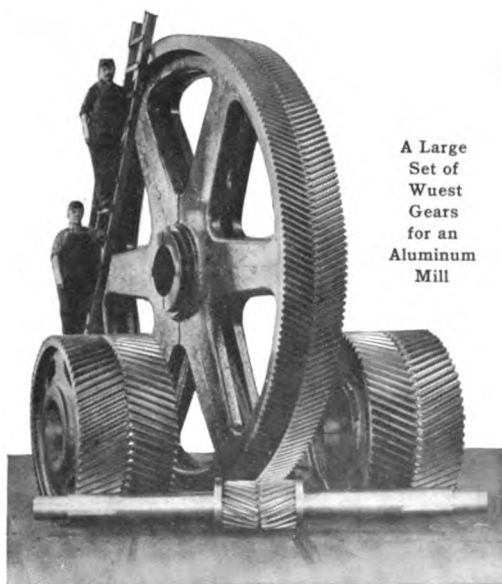
# THE FALK COMPANY

MILWAUKEE, WISCONSIN

**Manufacturers of Precision Herringbone Gears with Staggered Teeth (Wuest Patents)**

## WUEST HERRINGBONE GEARS

We manufacture a complete interchangeable system of herringbone gears, with teeth generated on special machines, designed and built exclusively for our own use.



A Large Set of Wuest Gears for an Aluminum Mill

Fig. 1

### SPECIAL ADVANTAGES

- Long life.
- High efficiency (loss never exceeds 1% at rated load).
- Elimination of countershafts and double-gear trains.
- Absence of vibration with prevention of shaft crystallization and breakdown of motor insulation.
- Quiet action with durable steel pinions.

Referring to illustrations, Fig. 1 shows a large set of Wuest gears for an aluminum mill. Fig. 2 shows a high ratio gear unit with 45° spiral angle gears for 3000 H. P. marine turbine drive—U. S. Navy. Fig. 3 is a standard type of herringbone gear unit for motor-driven rolling mills.

The gears which we produce are hobbled, both sides at once, in solid blanks.

The Wuest System of staggered teeth, besides giving the maximum contact surface for a given width of face, is invaluable in securing unbroken continuity of engagement when using high ratio pinions with very few teeth.

Other distinctive features:—

- Highest attainable accuracy.
- Involute tooth form on *circumferential* section.
- Invariable spiral angle.
- Perfect interchangeability.
- Equal efficiency in both directions.

### SIZES

- We manufacture hobbled herringbone gears in the following sizes:
- Any pitch, from 10 D. P. to  $\frac{3}{4}$  D. P.
- Any face, from  $1\frac{1}{4}$  inches to 72 inches.
- Any diameter, from 2 inches to 16 feet.
- True spiral gears of constant angle cut to standard diametral pitch like spur gears.

# THE FALK COMPANY

## WUEST HERRINGBONE GEARS

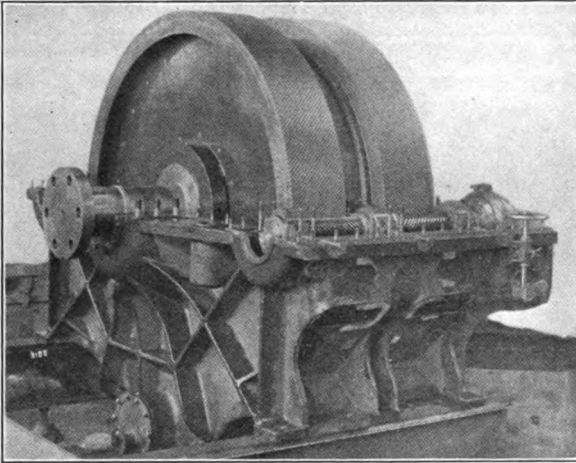


Fig. 2

WUEST HERRINGBONE GEARS transmit power by smooth, continuous action without jar, shock or vibration.

They are almost noiseless.

They can be used for extremely high *single* gear ratios. In this connection we make a specialty of forged pinions in one piece with their shafts. Ratios of 15 to 1 are quite normal and 20 to 1 may be used when necessary. Wuest gears can be run with safety at far higher velocities than the spur type. Special gears for use in connection with steam turbines are suitable for speeds up to 7000 feet per minute.

The range of application for Wuest herringbone gears covers every case where spur gears are used and many new fields where spur gears are impossible.

*Specially adapted for*  
 Marine Steam Turbines.  
 Turbo-Generators.  
 Turbine-Driven Centrifugal Pumps, Mills and Shafting.  
 Rolling Mills and Rod Mills.  
 Tube Mills and Crushing Plant.  
 Power Pumps.  
 Air Compressors and Blowers.  
 Hoisting, Elevating and Conveying Plant.  
 Rubber Machinery.  
 Machine Tools.

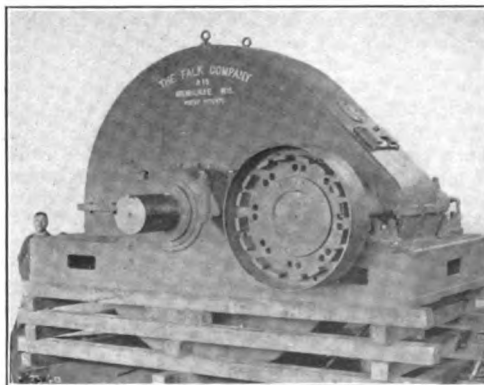
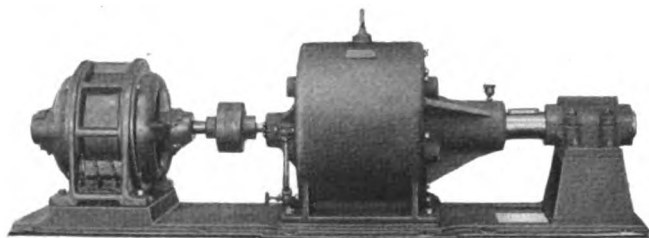


Fig. 3

## W. A. JONES FOUNDRY & MACH. CO.

4401 WEST 12TH ST., CHICAGO, ILL.

**Manufacturers of Pulleys, Sprockets, Friction Clutches, Rope Drives, Cast Gears, Cut Gears and General Power Transmission and Conveying Machinery**



### JONES SPUR GEAR SPEED REDUCER

7  $\frac{1}{4}$  Horse Power, Ratio 80 to 1, Motor Speed 1200 R. P. M., Driven Speed 15 R. P. M.

THE JONES SPUR GEAR SPEED REDUCER was developed after years of experience in the manufacture of power transmission machinery to fill the increasing and insistent demand for a compact, positive, reliable and efficient device for reducing electric motor speeds to those suitable for the ordinary machine or mill.

Complete reducing sets of Standard design can be furnished to meet all average requirements for motors ranging from one to two hundred horse power with the proper ratio to bring the driven speed within the limits of the slow speed drives customary in Mill, Factory, and Plant Equipment. We are prepared to supply plain reducers with Standard shaft projections keyseated for couplings, or to assemble Reducers with motors, Flexible Couplings and out board bearings complete on cast iron bases of various designs to suit conditions as illustrated above.

All reductions are made with spur gears and pinions of forged steel finished all over with the teeth accurately generated insuring perfect action as well as making all wheels strictly interchangeable. No internal gears are employed. Pinion shafts are supported at both ends in bronze bushed bearings, eliminating all overhanging pins.

The Reducing gears are completely enclosed in a substantial dust-proof, cast iron housing of neat and compact design which contains oil at a sufficient level to allow the gears to dip, thus providing automatically at all times a positive and copious lubrication for all internal moving parts. Friction and wear are consequently decreased to the minimum insuring efficiency, long life and low maintenance with only nominal operating attendance required. All parts are readily accessible for inspection as shafts with gears may be completely withdrawn by removing the slow speed head.

The Advantage derived by the use of speed-reducing sets makes them particularly attractive in comparison with other methods of speed-reducing systems. Their smooth, quiet operation is in decided contrast to the grinding and cutting of open gearing, running with insufficient lubrication; neither is there any slipping of belts, or breaking of chains, or fraying of ropes encountered, and no exposed moving parts to catch and injure careless workmen.

The speed reducer is simple, powerful, quiet, and dependable. Though all parts are accessible, it is a compact unit, occupying a very small space. Reducing sets are easy to install, economical to operate and do not require expert attention or adjustment.

*Each reducing problem is given a complete engineering analysis, insuring the selection of a machine amply proportioned for the full duty to be performed. It is only necessary in writing for complete information to mention motor speed and horse power, driven speed, or ratio required and class of service or character of operating conditions.*

# D. O. JAMES MANUFACTURING CO.

Established 1888

Incorporated 1908

1120-24 W. MONROE ST., CHICAGO, ILL.

Manufacturers of Speed-Reducing Transmissions, Cut Gears—Gear Cutting

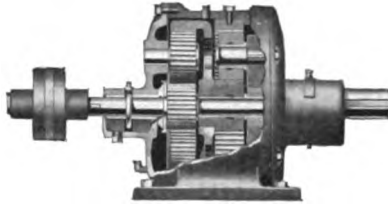
## JAMES SPEED-REDUCING TRANSMISSIONS

Ratios 4 : 1 to 1600 : 1

1 H. P. to 100 H. P.

*A Centrally Driven Well-Balanced Drive of Great Emergency Strength.*

James Speed-Reducing Transmissions were designed to eliminate the objectionable features in evidence in other forms of power transmission, and have been developed to meet the requirements of a variety of applications. They are semi-planetary, combining the best features of the purely planetary and non-planetary or spur gear type of transmissions. The James Reducer meets the demands for a reliable and efficient method for reducing the motor speed. Being fully enclosed, it positively eliminates all chances of dirt getting in the working parts and leaves no gears exposed to injure the workman.



**Compactly Constructed:** The James Reducer is a unit in itself, compactly constructed, having very much the appearance of an electric motor; is easily installed and can also be arranged for ceiling suspension. It will be found highly efficient, strong and durable, the gearing being entirely enclosed in housing, operating in oil under ideal conditions.

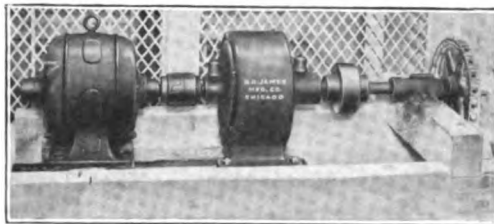


**Wide Range of Adaptability:** James Reducers are admirably adapted for use in brick plants, cement plants, coal mines, excavation work, steel mills, paper mills, and countless other industries of a like nature, where more or less dirt and grit are constantly getting in the exposed gearing, causing excessive wear, requiring but a few months in many instances for their complete destruction.

They find most satisfactory application for use in operating stokers, ore roasters, cereal cookers, conveying and elevating machinery of every description, car pullers, car loaders, hoists, freight and passenger elevators, stuff chests, agitators, mixers, paint chasers, feed driers, garbage driers. Starch and glucose plants will find the fully enclosed features most acceptable.

**Durability:** The long life of the James Reducer is largely due to the fact that the gearing is well balanced, all moving parts running in the same direction, the idlers revolving on case-hardened and ground-forged steel pins.

Each Reducer is thoroughly tested before being shipped.



7 1-2 H. P. James Speed Reducing Outfit, motor speed 1,140 r. p. m., driving a sprocket 40 r. p. m., which operates a conveyor on the floor below.

*Write for our latest Bulletin No. 6, describing James Speed Reducers.*

**CUT GEARS:** We are specialists in the manufacture of cut gearing and are fully equipped with the most modern machinery for the accurate production of large or small gears in any quantity.

We can furnish gears of every description—Bevel, Mitre, Spur, Spiral, Rawhide and Worm Gears—we can furnish them all and guarantee satisfaction.

*Write for our special gear catalog.*



# THE POOLE ENGRG. & MACHINE CO.

Established 1843

WOODBERRY, BALTIMORE, MD.

BOSTON OFFICE, 53 State St.

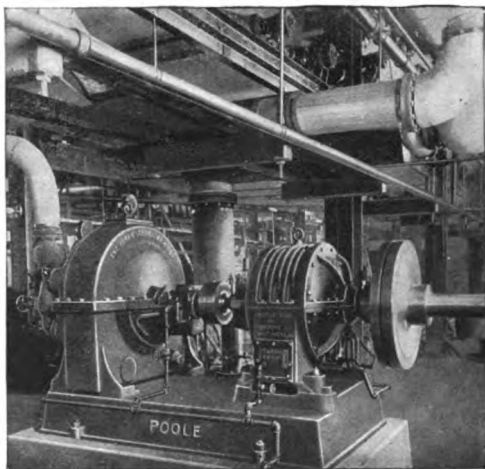
NEW YORK OFFICE, 50 Church St.

**Manufacturers of Gears and Power Transmission Machinery**

## THE TURBO-GEAR (Fast Patents)

The Internal Herringbone Turbo-Gear is a patented, self-contained, mechanical, power transmission interposed between and directly coupled to the prime mover and the driven unit. It may be used as either a step-up or step-down speed-transforming device.

**Gear Members:** The Turbo-Gear consists of a large, internal, double-helical gear made of a special-analysis, open-hearth, steel forging, heat-treated to increase its ductility and to insure uniform hardness. A double-helical pinion cut integral with the high-speed shaft, made of Halcomb-electric furnace chrome-vanadium steel, heat-treated to an elastic limit of 210,000 pounds per square inch and of proper hardness to minimize wear. Intermediate, double-helical gears made of high-carbon steel-forgings are mounted on hardened and ground, forged, steel shafts with Hyatt Roller Bearings and secured to the cast-steel, slow-speed member.



**500 H. P. Turbo-Gear Mill Drive**

On this slow-speed member, which is part of the slow-speed shaft, are mounted two heavy-duty S. K. F. Ball bearings, one on each side of the gears, and supported directly by the substantial housing. Thus it will be seen that the slow-speed member and shaft carrying the intermediate gears, and the high-speed shaft and pinion are independent of one another for support and yet each is supported directly by the housing. The internal gear is stationary, the moving members are the pinion and intermediate (planetary) gears.

The gear members in the Turbo-Gear are cut on a gear generator, specially designed for this purpose, that produces a true involute-shape stub tooth of unequalled accuracy and finish.

**Reliability:** The Turbo-Gear is built for long service. It is rugged and compact yet of ample proportion with low tooth pressures to resist overloads and shocks, as well as wear.

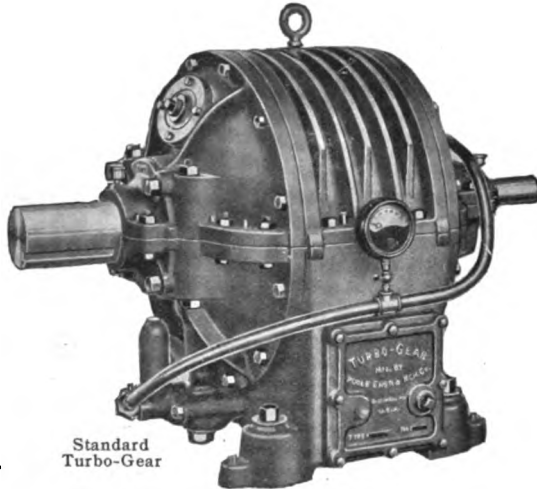




# THE POOLE ENGRG. & MACHINE CO.

## General Application:

Speed, efficiency and safety are the watch-words of the day. The Internal Herringbone Turbo-Gear meets all these requirements. It can be successfully employed for all kinds of gear drives, and used instead of the noisy, inefficient and highly dangerous methods of transmitting power through belts, ropes and chains.



Standard  
Turbo-Gear

*Turbo-Gears are used:*

in Cement Mills  
Rubber Mills  
Saw Mills  
Steel Mills  
Textile Mills

with Blowers  
Compressors  
Electric Motors  
Fans  
Gas Engines  
Line Shaft Drives  
on Electric Trucks, Electric Trolley Cars

Marine Motors  
Mechanical Stokers  
Oil Engines  
Pumps  
Refrigerating Machines  
Steam Turbines  
Steam Engines

159

There is no type of drive which would not be made less noisy, more efficient and use less power by adopting this transmission.

## Advantages:

**High efficiency** (98-99%).

**Safety** (no belts, chains or sprockets, no exposed gears, no guards required).

**Freedom** from noise and vibration.

**Small floor space** required.

**Totally enclosed** (can be used in wet, dirty, dusty, gritty places).

**Simplicity** (sprockets, chains, pulleys, belts, hangers, bearings, extra shafting, etc., eliminated).

**Reversibility** (can be used to either step-up or step-down the speed) and can drive in either direction of rotation.

**Low first cost** (lower than a complete gear, chain or belt drive).

**Low maintenance cost** (practically nothing).

**No side strain** on shafts or bearings (pure torque transmission).

**Low erection expenses.**

**No attention** or subsequent adjustments needed. Once properly set up always thereafter in running condition.

**Capacity:** The Turbo-Gear can be furnished in any capacity from 2 horse power up.

Large speed-reduction makes possible the use of a higher-speed, cheaper, more efficient motor.

Wider range of speed reduction than any other single-reduction form of drive.

Cool operation—sure proof of high efficiency.

All tooth pressures are balanced.

High- and low-speed shafts in axial alignment.

Each rotating member independently and directly supported by the housing.

Gears sprayed by a continuous stream of oil under pressure.

Six times as many teeth in constant contact as on any other form of Herringbone Gear drive for equal power. Consequently, low tooth pressure with corresponding increase of life.

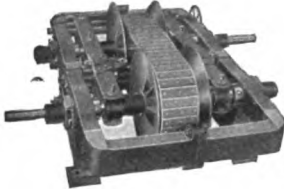
Lighter weight per horse power than any other complete reduction gear.

## REEVES PULLEY COMPANY

COLUMBUS, INDIANA

BRANCH HOUSE: Corner Clinton and Monroe Sts., CHICAGO

Sole Manufacturers of "The Reeves" Variable Speed Transmission, Wood Split Pulley, Wood Split Pulley Clutch and Roller Bearing



*The Reeves*

### VARIABLE SPEED TRANSMISSION

solves every problem of speed variation. It is a real speed regulator—one that may be applied to any machine and any desired speed secured in a moment, without stopping, not one revolution too fast nor one revolution too slow.

The construction and operation are very simple. Two pairs of cone-faced discs are mounted on parallel shafts in such manner that they are movable. A special V-shaped belt drives from one pair of discs to the other. Two pairs of levers, operated by a right- and left-threaded screw, move the discs so that as one pair separates the other pair is brought together an equal distance, thus changing the belt to different driving diameters and increasing or diminishing the speed of the variable shaft as desired. The speed is regulated by turning a hand wheel in one direction to increase and the other to reduce the speed.

"The Reeves" Transmission is used as a countershaft. You belt from the line shaft or motor to one shaft, which is driven at a constant speed, and the other shaft is variable. From the variable shaft you belt to the machine to be driven.

The Transmission is built in fourteen sizes to transmit from 2 H. P. to 150 H. P.; and seven classes to provide variation of 2 to 1 or as high as 10 to 1. It may hang from the ceiling, stand on the floor or be built into the machine it is to regulate.

### WOOD SPLIT PULLEY

"The Reeves" Wood Split Pulley is built of hardwood, select grade, thoroughly air and kiln dried and acclimated. Each segment glued and doubly nailed; arms are edgewise to the load, extending through, built up and made integral with the rim.

The arms split the air—have less air resistance or disturbance than steel. The belt adheres to the face better than to steel or iron and transmits from 20% to 30% more power with equal belt tension. 40% to 80% lighter than steel or iron, costs from 25% to 75% less, is stronger and more efficient in operation. Built any size from 3 inches to 30 feet diameter.



### ROLLER BEARING



"The Reeves" Roller Bearing takes the place of plain box in any standard make of hanger. Reduces friction, saves oil and labor, eliminates hot boxes and re-babbiting; saves its cost in a few months. Has numerous exclusive, valuable features.

*Special catalog of any line mailed on request.*

# MORSE CHAIN COMPANY

ITHACA, NEW YORK

## OFFICES AND REPRESENTATIVES:

BOSTON, 141 Milk Street  
CHICAGO, Merchants L. & T. Bldg.  
CLEVELAND, Engineers Bldg.  
DETROIT, 1003 Woodward Avenue  
NEW YORK, 50 Church Street  
PITTSBURGH, Westinghouse Bldg.

SAN FRANCISCO, Monadnock Bldg.  
ATLANTA, Earl F. Scott, M.E., Candler Bldg.  
GREENSBORO, N. C., G. W. Pritchett, 805 Ashboro St.  
KANSAS CITY, Morse Engineering Co., R. A. Long Bldg.  
MINNEAPOLIS, Strong-Scott Mfg. Co., 413 Third St., S.  
Sr. LOUIS, Morse Engineering Co., Chemical Bldg.

## Product—

### MORSE SILENT CHAIN

99% Efficiency



Morse frictionless "Rocker Joint" Silent Chains and Sprockets—a high speed, positive, and flexible drive of many and varied applications, which maintains an efficiency of over 99% by actual test, a claim that can be made by no other manufacturer of silent chains. From  $\frac{1}{4}$  H. P. to 5,000 H. P. For High or Low Speed.

## Difference—

The difference between the Morse Silent Chain and all other types is in that unseen and all-important part, the joint. The MORSE is constructed with the undeniable fact always in view—the joint must bear the burden of service in any chain. Instead of a single pin, as in other joints, two special pins, both seated, form the joint. No bushing is required. As the chain bends in circling each sprocket, the curved side of one pin rolls or rocks against the broad, flat side of the other, eliminating destructive sliding friction entirely. When on the straight run between sprockets, the flat sides of both pins are brought together, holding the chain steady and true.

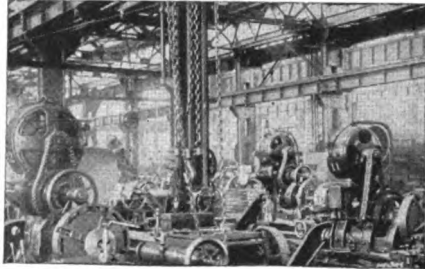
## Speed and Service—

This exclusive "Rocker Joint" construction enables the MORSE to run at a speed far in excess of other chains because lubricant is not essential to its operation; and after years of experimentation (in nearly every line of industry) it is accepted as the most durable chain on the market.

## Engineering Assistance—

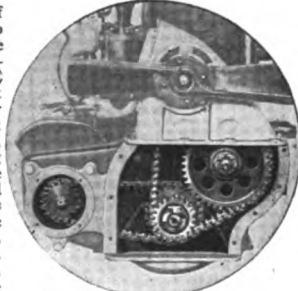
Our corps of engineers with years of experience in designing and installing millions of horsepower chain drives will assist you to solve your transmission problems.

This service is rendered gratis. Get in touch with them NOW.

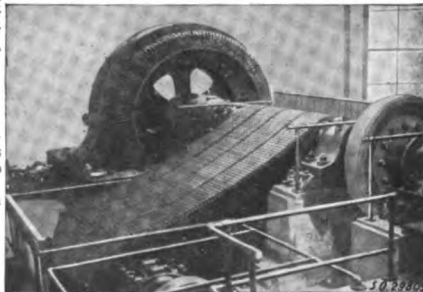


The small lathes shown are driven today by the same chains installed over 15 years ago. These chains are  $\frac{1}{8}$ " pitch,  $2\frac{1}{4}$ " wide and have required no repairs of any kind, their daily service being from 4 to 10 hours.

One of thirty-two automobile models using MORSE Silent Chains for the front end drive, among which are such well known cars as the Packard, Cadillac, Lozier, Stearns-Knight, National, Haynes, Winton, Jeffery.



Hupmobile "4"



## The Largest Chain Drive in the World

Five thousand h. p. Morse Silent Chain Drive from water wheels to generator, Ox Bow Hydro-Electric Plant, Snake River, Copperfield, Ore.

## THE BALDWIN CHAIN & MFG. CO.

WORCESTER, MASS.

Makers of Power Transmission Chains and Sprockets

### BALDWIN CHAINS

**Baldwin Chains** for transmission of power are made in two distinct types, block chains and roller chains.

**Block Chains** consist of solid steel blocks of section resembling either the letter B or figure 8, each separate block drilled to receive two revoluble studs to which the side links are attached. This class of chains is adapted to comparatively light work where the lineal speed of the chain does not much exceed 800 feet per minute.



All Baldwin Block Chains, except No. 5, are made detachable. They are as durable and as strong as the riveted chains of the same size. The value of the detachable feature of these chains is proved by the increased demand for them by the trade who find them very convenient for the ease with which they can alter the length of a chain to suitable requirements, either for changing the gearing or for quick repairs.

**Roller Chains**, as their name indicates, consist of rollers mounted upon hollow shafts, technically called bushings, a pair of which is fitted into side links to form the equivalent of the solid block used in the block chains. These built-up blocks are then connected by rivets or studs to other side links. The connection is either made permanent by riveting, or made separable by using studs provided with cotter pins at one end. The fastening to be selected will depend upon the nature of the work to which the chains are applied, or to individual preference.

This style of chain is adapted to the heaviest work and, if properly lubricated, is capable of standing up under a lineal speed as high as 1,200 feet per minute, or, under exceptional conditions, somewhat higher.

#### Cotter Pin Detachable Roller Chain

Baldwin Cotter Pin detachable chain can be easily separated at each link, and is well adapted for heavy motor trucks.

The side links on one side of the chain are riveted to the ends of the studs, and on the other side of the chain, the links are forced on to the studs, and retained by a cotter pin.



**Riveted Roller Chain:** The material used in the manufacture of these chains is carefully selected and particular attention is paid to the heat treatment given it. The neck of the rivet is a driving fit knurled and forced into the side link by power. This makes a connection that is superior for all requirements.

Baldwin machine-made roller and block chains are suited for a great variety of chain drives. It is our business to furnish estimates for chains and sprockets for various drives.

**SPROCKETS:** We have a large department equipped with the best facilities for the accurate and economical production of sprockets, in large quantities as well as for sample lots. No order is too small to interest us, nor too large for us to handle.

We carry only one grade of steel for our sprockets which has been selected after long experience, and which appears to be best adapted for wear.



# THE AMERICAN PULLEY COMPANY

4200 WISSAHICKON AVE., PHILADELPHIA

BRANCH STORES: **NEW YORK** **BOSTON** **CHICAGO** **SEATTLE**  
33 Greene St. 165 Pearl St. 114-116 S. Clinton St. 536 First Ave., So.

**Wrought Steel Belt and Sash Pulleys and Pressed Steel Shapes**



(Patented)

**3", 4", 5" and 6" DIAMETERS**

Note the sturdy construction. These small pulleys are as perfect in their way as larger "American" Pulleys. No more can be said.

**"AMERICAN"**

**ALL STEEL SPLIT PULLEYS**

**Good for Double Belts**

The original steel pulleys. Made for twenty years. Over 3,000,000 marketed.

These pulleys are correctly designed, and every detail of construction has been carefully studied.



(Patented)

**INTERMEDIATE SIZES**

Provided with grooved air escape. Six flat "A"-braced arms (edge on) give great rigidity and least air resistance. Riveting the ends of the arms to inner flange means a round pulley, strong where strength is needed.

The manufacturers invite experimental tests as to all points of efficiency—belt holding qualities of pulley face, method of crowning, economy as to air fanning, ease of application, high speeds, safety, ultimate strength, etc.

Data have been collected as to each point, and will be furnished on application.

The manufacturers will cooperate with engineers wishing to arrive at the actual facts as to efficiency, putting their testing apparatus at the disposal of inquirers.



(Patented)

**44" TO 120" DIAMETERS**

Grooved air escape. The hub shell is solidly riveted to half an annular hub ring of angle section. Eight arms, bifurcated at the base, are riveted through lap-joint bifurcations to an annular hub ring.

**"AMERICAN PULLEYS"**

All "Americans" above 6" diameter have grooved faces.

Listed sizes 3" to 120".

Crown and straight faces.

Interchangeable Bushings.

No Set Screws, and no Keyways unless for unusually heavy duty.

Stocked by over 200 dealers in the United States and Canada.

All pulleys fully guaranteed.

# DODGE SALES & ENGINEERING CO.

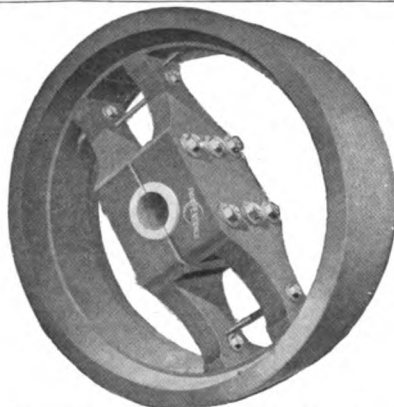
Distributors of the products of

**DODGE MFG. CO., MISHAWAKA, IND.**

15 Branch Warehouses in the United States.

Dealers in Every Representative City

**Designers and Builders of Everything for the Mechanical Transmission of Power**



"Independence" Wood Split Pulleys are lighter, stronger, steadier, than any other pulleys of their type; they insure the maximum tractive pull of belts and are guaranteed to give satisfactory service.

In these days when equal importance with reason for your specifying

"DELIVERY" is considered of "QUALITY," there is a double "Dodge" pulleys.

Dodge pulleys constitute the standard of the world in design, strength, interchangeability, service and prompt delivery.

"Independence" Dodge Wood Split Pulleys are 40 per cent to 80 per cent lower in price than any pulley made from any kind of metal.

They will stand up under any double belt service and will run successfully at any practicable speed.

Dodge Wood Split Pulleys are guaranteed. If they fail in any way to satisfactorily perform the function of a stock pulley, they may be returned and full credit will be allowed.

The Dodge "Standard" Iron Split Pulley is America's ideal service pulley. It is easily put up or taken down, and will fit shafting of all regular sizes. There are no rivets to shear or joints to work loose.

The Dodge "Standard" Iron Split Pulley is impervious to the weather, to water, to steam or acid fumes.

The Dodge "Standard" Iron Split Pulley does not become distorted under strain; it is perfectly round and gives a full 100 per cent belt contact.



The Dodge Interchangeable Bushing system makes possible the application of a pulley to any size of shaft within the range of standard bores as follows:

3" diameter	1 1/4" bore
4" diameter	2" bore
5 to 7" diameter	2 7/16" bore
8 to 23" diameter	3" bore
24 to 48" diameter	3 1/2" bore
50 to 72" diameter	4 1/2" bore



Bushings for Standard Iron Splits are made and finished whole, then cracked, and the fractured edges are dressed away slightly to provide for proper clamping clearance.

Two complete bushings are required for each pulley, one for each end of the pulley hub.



Split Iron center double strength wood rim pulley for heavy service in textile and cotton mills.



Split Iron center wood rim pulley with double arms especially adapted for use as high speed motor or generator use.



# DODGE SALES & ENGINEERING CO.

Distributors of the products of

## DODGE STEEL PULLEY CORPORATION

Main Office: MISHAWAKA, IND.

Steel Pulley Plant at ONEIDA, N. Y.

### Steel Split Pulleys



"Oneida" Steel Split Pulley



"Keystone" Steel Split Pulley

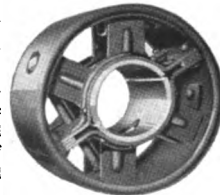
Oneida and Keystone Steel Split pulleys are now sold exclusively by the Dodge Sales and Engineering Company. The marked superiority of these steel pulleys over all similar products is at once evident to any one familiar with pulley construction.

The rims of the Oneida pulley are made of 10, 12 and 14 gage steel, according to the size of the pulley. Keystone rims are made of  $\frac{1}{8}$  and  $\frac{1}{4}$ " steel. This extra weight of metal is essential in any steel pulley to prevent breakage under strain or distortion at high speed.

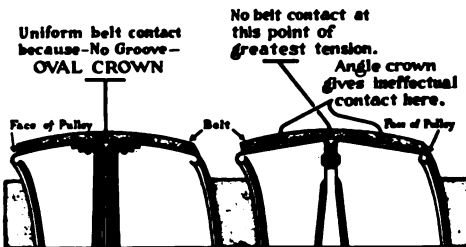
Both Oneida and Keystone pulleys possess the true oval crown rim which makes for greater uniform belt contact, because of the absence of a groove at the point of greatest tension, such as is found in other types of steel pulleys. Throughout the construction of both Oneida and Keystone pulleys, wherever two pieces of metal are riveted together, these metals are counter-locked male and female, so that there is positively no shearing or lateral strain on the rivets.

Oneida and Keystone pulleys are made in all sizes up to very large belt wheels for main engine drives.

Considerable literature has been prepared on the subject of steel pulleys. This will be sent to anyone interested.



"National" Steel Split Pulley



National Steel pulleys are made in 3, 4, and 5" diameters, 3" to 6" faces, and fill a long-felt want for a strong, efficient satisfactory small pulley.

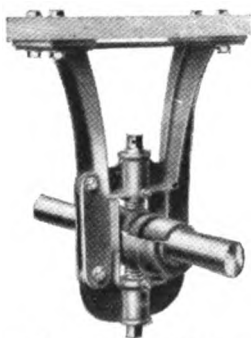
The National pulley has all the advantages of the bushing system, and being instantly available from dealer's stock, naturally premises to dispel, in a short time, all makes of pulleys now marketed.

National pulleys are suitable for use on small motors, dynamos, wood or metal working machinery, and, in fact, in all places requiring small well-balanced, efficient pulleys.

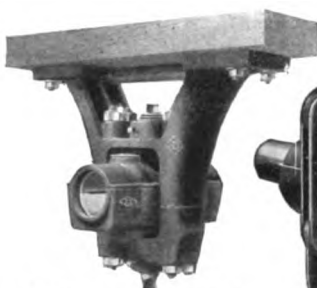
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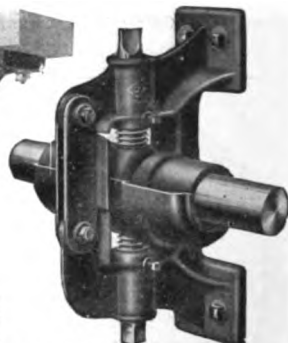
# DODGE SALES & ENGINEERING CO.



The Dodge Drop Hanger is ball-and-socket in its fitting.



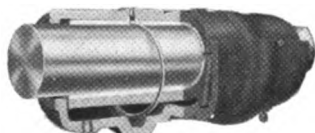
Dodge Heavy Head Shaft Hangers fitted with Ring-oiling bearing. Made in two standard "drops" of 12 and 18 inches.



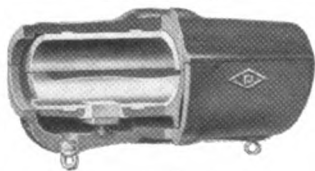
Adjustable Ball - and - Socket Post Hanger with Standard and Self-oiling Bearings. Ample adjustment; machined base.



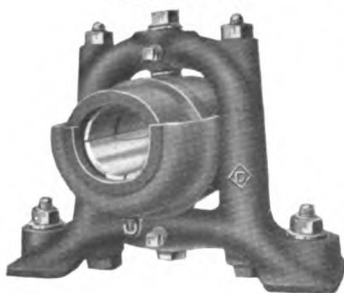
Plain Bearing



Ring Bearing



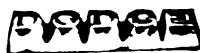
Capillary Bearing



Adjustable Pillow Block has open frame and ball-and-socket principle. When inverted forms a head shaft hanger.



Capillary and Ring-oiling Rigid Pillow Blocks adapted to the most severe service. May be ordered with dust-proof ends.



"Dodge" Bearing Metal is intended for use under all general conditions, the "Copper Hardened" brand being better suited for places where there is considerable vibration, knock or pound to contend with.

Our "Genuine" brand is intended for use in bearings where heavy crushing strains are involved. We make a brand of metal for every service condition.



Common Flat Box for use under conditions where moderate powers are involved and where heavier self-oiling equipment is unnecessary.

For pleasing appearance, ample strength, wide adjustability, easy erection, perfect alignment, and general mechanical quality there has never been produced an equal to the Dodge double brace, ball-and-socket hanger, made on both "drop" and "post" styles.

Designed for the utmost strength in form and proportions, it is nevertheless of pleasing appearance in its lines of symmetry and its distribution of metal. To the mechanical eye, these features are all quite in harmony, each having its share in creating and sustaining an impression of confidence in the general excellence.

Each frame with a given jaw size will receive the hanger boxes for a range of  $\frac{1}{2}$  inch of shaft diameters. For example, the "C" frame will accommodate all diameters from  $2\frac{1}{4}$  to  $2\frac{1}{2}$  inches. All hangers for these shaft sizes have jaws of same dimensions, the various "drop" distance being provided by different lengths of legs. The longer legs naturally give the greater spread and larger feet desirable for the longer drops.

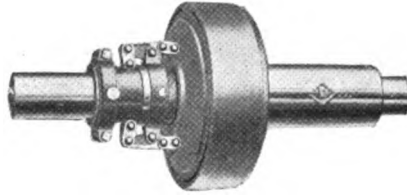
In the new Dodge Book C-16 the subject of hangers and bearings is discussed fully. Correct engineering tables are given as well as suggestions for a wide number of unusual uses of hangers; pillow blocks, floor stands, etc.



# DODGE SALES & ENGINEERING CO.

The Dodge Solid Friction Clutch is particularly adapted for countershaft use, and such other places where a solid type of clutch can be advantageously employed, and where the power requirements are within the range of capacities offered in this style of construction.

Any kind of a pulley—wood, iron center wood rim or iron, and either solid or split—or any gear, sprocket or sheave wheel, can be used upon this clutch.



Rated Capacities of Dodge Solid Friction Clutches when Operating at Speeds Shown

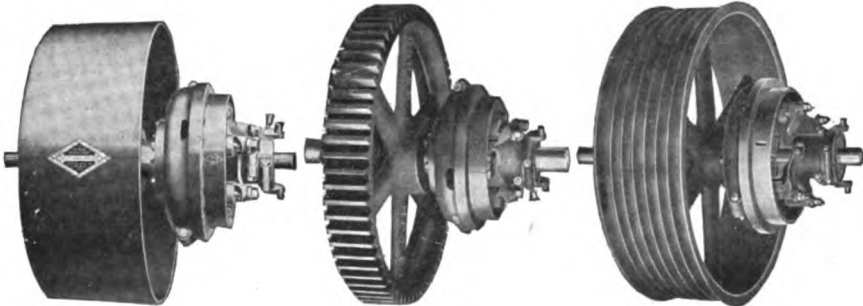
Size of Clutch	REVOLUTIONS PER MINUTE																Maximum Speed	Maximum Bore	
	100		150		200		250		300		350		400		450			500	
	H. P.	W. P.	H. P.	W. P.	H. P.	W. P.	H. P.	W. P.	H. P.	W. P.	H. P.	W. P.	H. P.	W. P.	H. P.	W. P.		Reg.	Spec.
4"	1 1/4	1 1/4	1 3/4	1 3/4	2 1/4	2 1/4	2 3/4	2 3/4	3 1/4	3 1/4	3 1/2	3 1/2	4 1/4	4 1/4	5 1/4	5 1/4	800	1 1/2	1 1/2
5"	2	2	3	3	4	4	5	5	6 1/4	6 1/4	7	7	8 1/4	8 1/4	10	10	800	1 3/4	1 3/4
6"	3	3	4	4	6	6	8	8	10	10	12	12	15	15	18	18	800	2 1/4	2 1/4
7"	4	4	6	6	8	8	10	10	12	12	15	15	18	18	22	22	800	2 3/4	2 3/4
8"	5	5	7	7	10	10	13	13	16	16	20	20	24	24	30	30	800	3 1/4	3 1/4
9"	6	6	9	9	12	12	15	15	18	18	22	22	28	28	35	35	800	3 3/4	3 3/4
10"	10	10	15	15	20	20	25	25	30	30	38	38	45	45	55	55	800	4 1/2	4 1/2
12"	15	15	22	22	30	30	38	38	45	45	55	55	65	65	80	80	800	5 1/2	5 1/2
14"	20	20	30	30	40	40	50	50	60	60	75	75	90	90	110	110	800	6 1/2	6 1/2
16"	30	30	45	45	60	60	75	75	90	90	110	110	135	135	165	165	800	8 1/2	8 1/2



Dodge Patent Split Friction Clutches make possible two things of great importance and value:

(1) The easy and ready installation of the equipment upon a shaft already in place without taking down the shaft or disturbing any of the equipment upon same, and

(2) The greatest possible facility in the taking off of old parts and the substitution of new, in the event that any repairs or renewals are necessary.



Dodge Split Friction Clutch with Dodge Split Iron Pulley.

Dodge Split Friction Clutch with Spur Gear.

Dodge Split Friction Clutch with Rope Sheave.

The Dodge Patent Split Friction Cut-Off Coupling is used for the purpose of connecting together two sections of shafting in such a way that one section can be stopped or started at will while the other section is operated continuously.

The mechanism of the Dodge Patent Split Friction Cut-Off Coupling is the same as is employed with the friction clutch for use with pulleys, gears, sheaves or sprockets. Instead, however, of the extended loose sleeve, a hub part is used, which is keyed to one of the shafts and provides a bronze bushing for receiving the extended part of the other shaft to which is keyed the driving plate of the mechanism.

The subject of clutches is an important one and is fully described in the Dodge Book C-16, in addition to other special literature devoted to the subject. It will be sent on request.

Rated Horse Power Capacities of Dodge Split Clutches

Size of Clutch	REVOLUTIONS PER MINUTE												*Maximum Speeds		Maximum Bore		
	100		150		200		250		300		350		400			C. I. Sleeves	Bab. Sleeves and Quills
	H. P.	W. P.	H. P.	W. P.	H. P.	W. P.	H. P.	W. P.	H. P.	W. P.	H. P.	W. P.					
10	6	6	9	9	12	12	15	15	18	18	22	22	25	25	250	450	2 3/4
12	10	10	15	15	20	20	25	25	30	30	38	38	45	45	350	600	3 1/4
14	15	15	22	22	30	30	38	38	45	45	55	55	65	65	450	800	3 3/4
16	20	20	30	30	40	40	50	50	60	60	75	75	90	90	550	1000	4 1/4
18	25	25	38	38	50	50	62	62	75	75	90	90	110	110	650	1200	4 3/4
20	32	32	48	48	64	64	80	80	100	100	125	125	150	150	750	1400	5 1/4
22	40	40	60	60	80	80	100	100	125	125	156	156	187	187	850	1600	5 3/4
24	50	50	75	75	100	100	125	125	156	156	195	195	236	236	950	1800	6 1/4
26	60	60	90	90	120	120	150	150	187	187	231	231	281	281	1050	2000	6 3/4
28	70	70	105	105	140	140	175	175	220	220	275	275	336	336	1150	2200	7 1/4
30	80	80	120	120	160	160	200	200	250	250	312	312	381	381	1250	2400	7 3/4
32	90	90	135	135	180	180	225	225	281	281	350	350	429	429	1350	2600	8 1/4
34	100	100	150	150	200	200	250	250	312	312	390	390	478	478	1450	2800	8 3/4
36	110	110	165	165	220	220	275	275	344	344	429	429	527	527	1550	3000	9 1/4
38	120	120	180	180	240	240	300	300	377	377	469	469	576	576	1650	3200	9 3/4
40	130	130	195	195	260	260	330	330	410	410	510	510	635	635	1750	3400	10 1/4
42	140	140	210	210	280	280	360	360	444	444	551	551	684	684	1850	3600	10 3/4
44	150	150	225	225	300	300	390	390	480	480	594	594	733	733	1950	3800	11 1/4
46	160	160	240	240	320	320	420	420	516	516	636	636	782	782	2050	4000	11 3/4
48	170	170	255	255	340	340	450	450	552	552	678	678	831	831	2150	4200	12 1/4
50	180	180	270	270	360	360	480	480	588	588	720	720	880	880	2250	4400	12 3/4
52	190	190	285	285	380	380	510	510	624	624	762	762	929	929	2350	4600	13 1/4
54	200	200	300	300	400	400	540	540	660	660	804	804	978	978	2450	4800	13 3/4
56	210	210	315	315	420	420	570	570	696	696	846	846	1027	1027	2550	5000	14 1/4
58	220	220	330	330	440	440	600	600	732	732	888	888	1076	1076	2650	5200	14 3/4
60	230	230	345	345	460	460	630	630	768	768	930	930	1125	1125	2750	5400	15 1/4

(Continued on next page)

(Continued from preceding pages)

# DODGE SALES & ENGINEERING CO.



range of service conditions. The English system is occasionally used on certain large drives where the conditions are proper for that system.

The advantages of transmitting power by means of rope are:

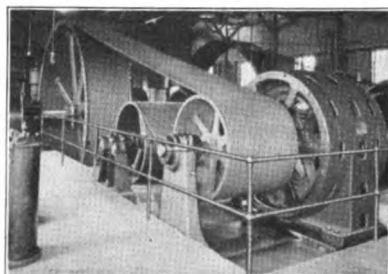
1. Distance and direction in which power is transmitted are practically unlimited.
2. Transmission of any amount of power.
3. Economy in first cost and maintenance.
4. Economy of space.
5. Positive drive, smooth running, and noiseless.
6. No electrical disturbance or loss of power by slipping.
7. Ease and simplicity of distributing power to the several floors of mill buildings, or from one building to another.

There are now in use two so-called systems of Manila rope driving—the Dodge American, or continuous rope system, and the English, or Multiple rope system.

The Dodge American System uses but one continuous rope, winding over all of the grooves, with the rope on the slack side forming a loop over an idler sheave and a traveling tightener, the tightener being controlled by a weight, so that it may automatically regulate the tension of all the wraps of rope.

The English system uses separate and independent endless ropes in each groove of the wheel, depending on the weight of the ropes for tension, and pinched grooves for adhesion.

The Dodge American System is the one now most universally employed because of its much greater adaptability for a wide



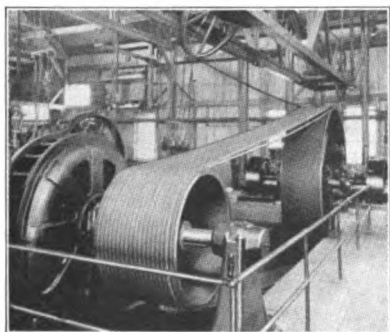
8. While it is important that in the original design of a rope drive all the details should have the attention of an experienced engineer who has specialized on that class of work, the equipment can be successfully operated and maintained by any mechanic of ordinary ability.

9. Precise alignment of shafting not necessary.

10. Lack of that extreme rigidity found in gear drives.

11. In its operation there is present that inertia, or what might be termed fly-wheel effect, which will ease off the peak and shock loads, a particularly valuable feature when motors are involved.

It is not possible to cover here in a complete manner the general subject of rope driving. We issue, therefore, special catalogues devoted to this method of transmitting power, which catalogues will be sent upon request.



Horsepower Capacities of Dodge American System of Rope Transmission  
Horsepower of One Rope Based on an Arc of Contact of 180°

Rope Diameter	ROPE SPEED IN FEET PER MINUTE									
	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
1/2	1.5	3.0	4.5	5.8	7.1	8.1	9.0	9.7	10.2	10.4
3/4	2.1	4.1	6.1	8.0	9.7	11.3	12.6	13.7	14.5	15.1
1	2.7	5.4	8.0	10.5	12.8	14.9	16.8	18.4	19.7	20.6
1 1/4	3.4	6.8	10.2	13.3	16.3	19.1	21.6	23.8	25.6	27.0
1 1/2	4.3	8.5	12.6	16.5	20.3	23.8	27.0	29.8	32.3	34.3
1 3/4	5.2	10.2	15.2	20.0	24.6	29.0	33.0	36.6	39.7	42.4
2	6.4	12.2	18.4	23.9	29.4	34.6	39.5	43.9	47.9	51.3
2 1/4	8.3	16.6	24.7	32.7	40.3	47.6	54.5	60.8	66.7	71.9
2 1/2										76.4

# FALLS CLUTCH & MACHINERY CO.

CUYAHOGA FALLS, OHIO

(SUBURB OF AKRON)

BRANCHES WITH COMPLETE STOCKS

NEW YORK, N. Y.  
206-208 Fulton St.

BOSTON, MASS.  
52-56 Purchase St.

CINCINNATI, O.  
134 W. Second St.

Shafting, Couplings, Collars, Bearings, Hangers, Pillow Blocks, Base Plates, Floor Stands, Head Shaft Hangers, Quills, Pulleys, Sheaves, Friction Clutch Pulleys, Friction Clutch Couplings, and a Complete Line of Power Transmission Machinery

## FALLS FRICTION CLUTCHES



6 Arm F. C. Coupling



Friction Clutch Quill



Rope Sheave



4 Arm F. C. Pulley



Gas Engine Type F. C. Pulley



Standard Iron Pulleys

Over twenty-five years ago the Falls Friction Clutch first came into prominence by meeting the demand of designers, builders and owners of electrical plants for a connection between the driving units and dynamo and generators, permitting any number of large units to be connected to the same source of power through Clutch Pulleys, Couplings and Quills.

The next demand came in the development of the Gas Engine, requiring a rugged clutch to withstand the severe shocks of this type of power unit, allowing the machine to be started up and brought to working speed before the load is connected.

Today, the Falls Friction Clutch is one of the prime factors in adapting the simplest, most efficient and most useful of power units, the Induction Motor. With a Falls Friction Clutch Pulley or Friction Clutch Cut-Off Coupling the motor can be easily started and load applied after running up to full speed, eliminating the expensive equipment necessary to start the motor under full load and keeping it in its simplest and most efficient form.

Throughout all these years, the Falls Friction Clutch has proven its adaptability to any and all classes of service, from low to high power requirements, and today retains its prestige as the most powerful and efficient of all Friction Clutches.

## ROPE DRIVES

We are specialists in designing and equipping rope drives for any and all classes of service. Manila Rope Drives of either American or Continuous Rope System, or English or Multiple Rope System.

Wire Rope Drives and Special Sheaves.

**CAST IRON PULLEYS** for all services, solid, split, or clamp hub, double arm, heavy rims, and Fly Wheels.

**SHAFTING** of Hammered Forged Stock and standard drawn or turned.

**BEARINGS** of all types for the lightest to the heaviest service, either self-oiling, ring-oiling or grease.



We maintain an up-to-date Machine Shop, fully equipped, and have our own foundries, enabling us to specialize to your Transmission Equipment requirements.

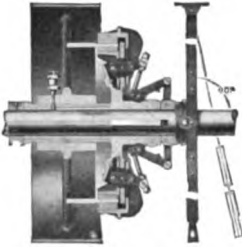
Engineering  
Corps  
at your service.

## THE HILL CLUTCH CO.

CLEVELAND, OHIO

NEW YORK SALES OFFICE, 50 CHURCH STREET

**A Complete Line of Power Transmission Machinery for Belt and Rope Drive, Including the Patented Hill Friction Clutch (Smith Type) and Collar Oiling Bearings**



**Sectional View Hill Clutch Pulley (Smith Type)—(Patented)**

Built solid or split in sizes from 9 to 1300 H. P. at 100 R. P. M.

### HILL FRICTION CLUTCHES

(Smith Type)

The improved Smith Type Hill Clutch is the latest development of the well-known Hill Clutch which we have successfully manufactured for the past 33 years. Vise-like jaws grip the ring in pairs, actuated by a powerful toggle mechanism. No springs. Clutch is self-centering, and in a cut-off coupling no alignment bushing is required, so when clutch is disengaged there are no parts in contact, therefore no wear.

In specifying Hill Friction Clutches call for the improved Smith Type to insure your obtaining the latest design, and a clutch of great mechanical stability and large starting power—two essential features in friction clutch design.

### HILL COLLAR OILING BEARINGS

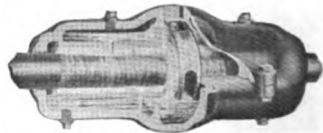
In the Hill Collar Oiling Bearing, instead of depending upon a loose ring or chain for conveying oil to journal, a fixed collar is employed, thus providing a positive means of elevating the oil that never fails.

In the Cleveland Type Collar Oiling Bearing oil stored in a reservoir in the bottom of the bearing is continuously elevated by a heavy split collar. Metal wipers deflect the oil which is then distributed along the full length of the journal.

In the Standard Type Collar Oiling Bearing the oil is elevated to an upper reservoir by means of a similar heavy split collar, clamped to the shaft. From the upper reservoir the oil flows by gravity over the entire bearing surface.



**Sectional View Hill Collar Oiling Bearing, Cleveland Type, Patented**



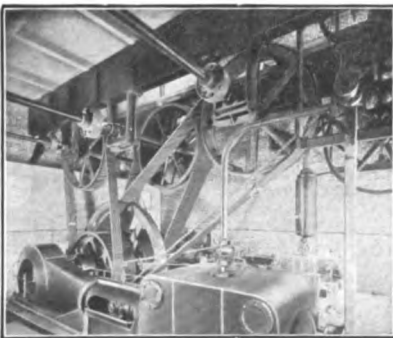
**Sectional View Hill Collar Oiling Bearing Standard Type**

### HILL ROPE DRIVES

American and English System Rope Drives, designed, built and installed.

Our twenty-six years' experience enables us to recommend the best method of installing each individual drive to meet customers' requirements.

Preliminary information furnished free of charge to all contemplating new drives or changes in their present system.



**Installation of Hill American System Rope Drive**



# THE CARLYLE JOHNSON MACHINE COMPANY

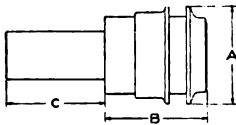
MANCHESTER, CONN., U. S. A.

Manufacturers of Friction Clutches

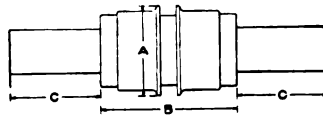
## THE JOHNSON FRICTION CLUTCH

A Small, Compact, Light Powered Clutch for Use on the Overhead Shafting and as a Part of All Makes of Machinery

*Our Black Catalogue sent free—Write now*



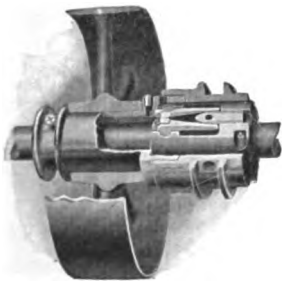
Single Clutch



Double Clutch

### DIMENSIONS OF STANDARD SINGLE AND DOUBLE CLUTCHES

Clutch Size Number	Horse-power 100 R. P. M.	Largest Diameter Clutch Will Bore	Dimensions				Throw to Engage Clutch	Weight of Standard Single Clutch	Weight of Standard Double Clutch
			A	Single B	Double B	C			
0	1/8	1 1/8"	3 1/8"	3 1/4"	5"	3"	1 1/8"	10 lbs.	20 lbs.
2	3/8	1 1/4"	4 1/8"	4 1/4"	6 1/2"	4"	1 1/8"	12 lbs.	25 lbs.
4	1	1 1/2"	5 1/8"	5 1/4"	7 1/2"	5 1/2"	1 1/4"	19 lbs.	32 lbs.
5	1 1/2	1 3/4"	5 3/8"	5 3/4"	8 1/2"	6"	1 1/2"	27 lbs.	43 lbs.
6	2	2"	6 1/8"	6 1/4"	9 1/2"	6 1/2"	1 3/4"	35 lbs.	54 lbs.
8	2 1/2	2 1/4"	6 3/8"	6 3/4"	11 1/2"	8 1/2"	1 7/8"	53 lbs.	96 lbs.
10	3	2 1/2"	6 5/8"	6 5/4"	13 1/2"	8 3/4"	2"	75 lbs.	110 lbs.
11	4	3"	9 1/8"	6 3/4"	10 1/2"	8 1/2"	1 1/4"	130 lbs.	150 lbs.



Section Broken Away, Showing Clutch Engaged and Pulley Mounted on Hub of Friction Cup

**Construction:** As seen by the illustration, this type of Clutch has but few parts and is very compact. A body fastened to the shaft carries a split ring in which are inserted a pair of levers. A curve-shaped wedge, which is made part of a shipper sleeve, forces the levers apart, expanding the ring, bringing its outer surface into frictional contact with the inner surface of the friction cup, the hub of which is made to suit requirements.

The leverage is so compounded that it requires but little pressure to operate the Clutch.

One screw which moves two taper blocks, set into the levers, adjusts the contact of the ring and cup to any tension. This is easily reached with a screwdriver through hole in the friction cup. The perfectly smooth shipper sleeve entirely covers the working parts so no dirt can get near them. The Double Clutch requires but

little more space than the Single, and has two friction cups with hubs, on which can be mounted pulleys, cones, gears, etc., of any diameter and face.

## T. B. WOOD'S SONS COMPANY

CHAMBERSBURG, PA.

Manufacturing Engineers, Power Transmission Machinery



Showing Different Forms of Keyseats

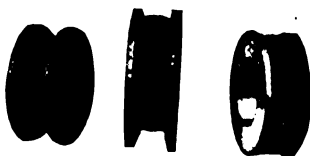
### SHAFTING

We are prepared to furnish shafting of the best steel in diameters up to 24", made perfectly round and straight, thereby insuring easy running and also minimum loss of power.

### SAFETY SET COLLARS

These are made either Solid or Split, bored to fit any size of shafting. Finished all over and fitted with hardened Set Screws. Constructed so that all bolts and Set Screws are protected by flanges projecting beyond heads and nuts. The heads of all Clamping Bolts in Split Collars are slotted.

We also supply Concealed Fast Collars forged from bar steel, bored slightly under size, shrunk on shaft, then turned and finished on shaft centers, thereby insuring a true running collar.



Safety Set Collars

### COUPLINGS

This line consists of Flange or Plate Couplings, Male and Female, or Standard Plain Face Type. Double Cone, Improved Collins and Universal Giant Compression Couplings, the latter being the Coupling that requires no keys. Ribbed Compression Couplings, Shifting Jaw Clutch Couplings, either Spiral or Square Jaws, Solid Sleeve and Universal Joint Couplings.



Universal Giant Compression Coupling

### HANGERS

Our line consists of many different types of Hangers all of a modern design, possessing unique adjusting and power-saving features, fitted with Ring Oiling, Chain Oiling or Plain Grease Cup Bearings.

We are also prepared to equip Hangers with Closed End Bearings and Bearings recessed for Collars. This line comprises Line Shaft, Heavy and Extra Heavy Headshaft Drop Hangers, Post Hangers and Bracket Hangers, all being made in both the Ball and Socket and Four Set Screw or Peerless Type.

We also supply Adjustable Girder Clamps of a unique design, Countershaft Parts or Complete Countershafts.



Hanger

### PILLOW BLOCKS, ETC.

From our many different patterns we are prepared to supply Rigid and Adjustable Pillow Blocks suitable for operation under various conditions. This classification comprises Plain Flat Boxes, Standard Rigid, Wick, Ring and Chain Oiling Rigid Pillow Blocks and Post Hangers; Solid Journal Boxes, Ball and Socket and Four Set Screw Ring Oiling Adjustable Pillow Blocks; also Plain or Wedge Adjustable Base Plates; Cast Iron and Steel Arch Wall Frames; Cast Iron Wall Brackets, Plain and Wedge Adjustable Ball and Socket Floor Stands, and Fire Wall Sleeves.



Pillow Block

# T. B. WOOD'S SONS COMPANY

## PULLEYS

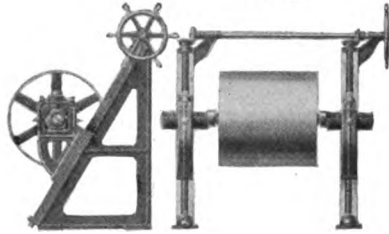
We manufacture Cast Iron Pulleys only, of a correct design having metal properly distributed, same being carefully finished and balanced. This type of pulley we believe superior to others as it is permanent and suited to a wider range of service. We are prepared to furnish Cast Iron Pulleys of every description.



Pulley

## BELT TIGHTENERS, ETC.

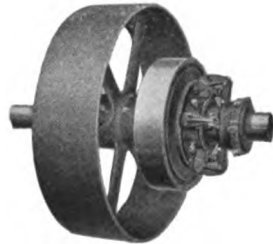
This line comprises Belt Tighteners made with "A" Frames and Vertical Side Frames, all with Screw Adjustment; in addition, Rack and Pinion Tighteners for Horizontal or Vertical use. We are also prepared to furnish Stationary and Adjustable Mule Pulley Stands, Single and Double Brace Binder Frames and Guide Pulleys.



Belt Tightener

## UNIVERSAL GIANT FRICTION CLUTCHES

These Clutches are of the Disc Type, of a consistent design throughout and are made either solid or split, the same type of construction being used for all sizes and all speeds. The Clutch is complete within itself either for use as a Cut-Off Coupling or for use in connection with ordinary Pulleys, Gears, Rope Sheaves, Sprockets or any regular or special part that it is desired to use as a driving or driven mechanism. The Sleeve and Body of this Clutch being independent, both are held rigidly in lateral position upon mounting and sustain no end thrust whatever when clutch is thrown in or out of engagement. The Friction Surfaces are protected from dust, dirt and other foreign substances. If desired, Clutch may be equipped with special cover to protect mechanism.



Universal Friction Clutch Pulley

## BELT AND CLUTCH SHIFTING MECHANISMS

We supply Belt Shifters which may be attached to any of our Hangers. We also furnish for Friction Clutches, Fork and Lever Stands, Compound Levers, Worm Geared or Single or Double Spur Geared Shifter Stands.

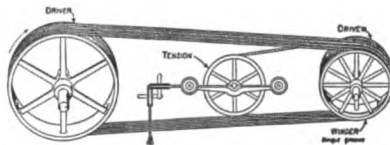


Compound Lever Shifter Stand

## ROPE TRANSMISSION

We are prepared to make complete installations of either English or American System Drives, and also to furnish Rope Sheaves with Grooves of every description; Tension Carriages, Track, Track Hangers and Tail Rope Sheaves.

We have at your command Engineers who have had years of experience in designing and installing satisfactory Rope Driving Equipments, whom we will be glad to have plan drives to meet conditions as they may exist.



Rope Drive

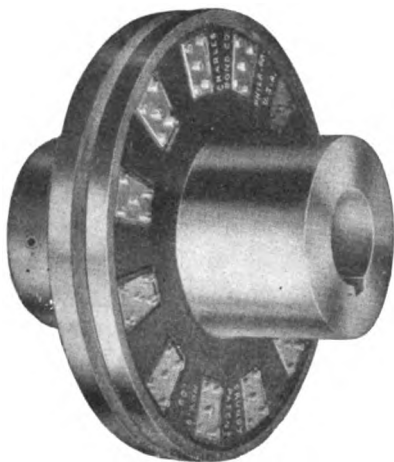


# CHARLES BOND COMPANY

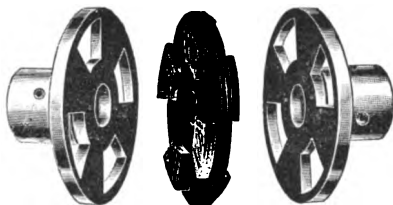
520 ARCH ST., PHILADELPHIA, PA.

Manufacturers of Power Transmitting Machinery and Leather Belting

## THE GRUNDY PATENT FLEXIBLE INSULATED COUPLING



Cast Iron      Leather      Cast Iron



Constructed of three pieces only, the two outer flanges being of cast iron, and the centre disc of non-conducting material, with lugs on each side for transmitting the power to the outside flanges.

The central disc is made of specially selected leather with lugs securely cemented and riveted to each side of same. The larger sizes, No. 12 to No. 30 inclusive, lugs are bolted on, and re-enforced with steel plate.

Specially adapted for connecting motors to Pumps, Machine Tools, Sewing Machines, Wood-working Machinery, Printing Machinery, Fans, Blowers, etc.

A simple and effective device for connecting the two ends of Shafting where it is difficult to get the bearings in perfect alignment, or where they are liable to get out of adjustment.

The driving disc being non-conducting material, acts as a thorough insulator.

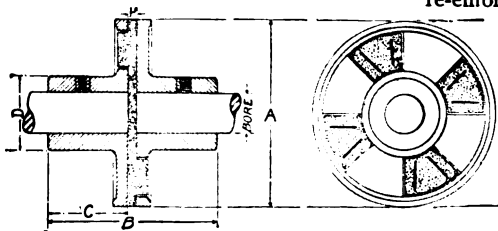
Being only three pieces to the entire Coupling, there are no complicated parts to get out of order.

Can be either set screwed or key seated or both.

Is a Safety Coupling, there being no projections to cause danger.

In appearance, is very similar to the ordinary plate coupling.

Will transmit more horse power than any other flexible coupling of equal diameter.



No.	A	B	C	D	P	Max. at Bore	H. P. 100 R P M	No. of Lugs	Approx. Wgt. Lbs.	List Price
3	3	"	1 1/4"	1 1/4"	1/8"	1 1/2"	3 1/2	3	1 1/4	\$ 7 00
4	4	"	1 1/2"	1 1/2"	1/8"	1 1/2"	5	4	5	8 40
5	5	"	2 1/4"	2 1/4"	1/8"	1 1/2"	3	4	8	10 00
6	6	"	2 1/2"	3	1/8"	1 1/2"	5	4	12	15 20
7	7	"	3 1/4"	3 1/4"	1/8"	1 1/2"	8	4	15	20 00
8	8	"	3 1/2"	3 1/2"	1/8"	2 1/4"	13	4	25	26 00
9	9	"	3 3/4"	4 1/4"	1/8"	2 1/4"	16	4	35	32 00
10 1/2	10 1/2	"	4	5 1/4"	1/8"	2 3/4"	35	6	50	50 00
12	12	"	6	6 1/4"	1/8"	3	55	7	100	65 00
14	14	"	7	8	1/8"	4	70	8	150	90 00
16	16	"	7 1/2"	9 1/4"	1/8"	5	95	9	285	135 00
18	18	"	8	10 1/4"	1/8"	6	125	10	350	160 00
21	21	"	9	13	1/8"	7	180	12	575	245 00
24	24	"	9	14 1/2"	1/8"	8	270	12	750	300 00
30	30	"	10	19	1/8"	11	500	16	1500	450 00

\* For standard sizes, the dimensions of "B" are twice "C" plus "P," but the length of hubs can be changed to suit conditions.

\*\* Maximum capacity under steady load.

When hubs of larger diameter than given in "D" are required, add 10% to list.



# AUBURN BALL BEARING COMPANY

Established 1893

22 ELIZABETH STREET, ROCHESTER, N. Y.

Manufacturers and Engineers

Ball Bearings for Every Service



Open T-114 Style  
Single Thrust



## AUBURN FOUR POINT CONE CONTACT BALL THRUST BEARINGS

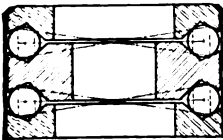
Each ball contacts constantly with both an inner (shorter) and an outer (longer) track on each race, yet it slides on neither of the four tracks, but rolls as freely as in a straight line across a table, and thus practically without friction. Made in sizes from  $1\frac{1}{4}$  inches to 26 inches outside diameter.

*Write for bulletin of sizes.*

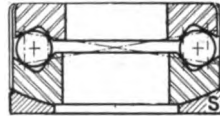
We design and make special ball bearings for unusual conditions of service when bearings of regular size or design are not entirely suitable. Send particulars of your problems.



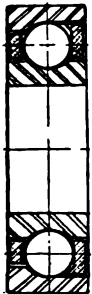
Enclosed T-100 Style  
Single Thrust



Enclosed T-150 Style  
Double Thrust



Enclosed T-170 Style  
Spherical Seat Thrust



Single Row



## ANNULAR BALL BEARINGS

Made to Metric or English dimensions in sizes from  $1\frac{1}{8}$  inches diameter to 26 inches outside diameter.

*Write for bulletin of sizes.*



Double Row



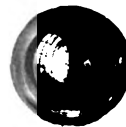
## VALVE BALLS

Solid and Hollow, of Brass, Bronze and other metals from  $\frac{1}{8}$  inch up.



## COLLARS AND RACES

of tool steel made to customers' specifications.



## STEEL BALLS

of alloy and carbon tool steel from  $\frac{1}{8}$  inch up.

# GURNEY BALL BEARING COMPANY

Conrad Patent Licensee

CHICAGO, ILL.

JAMESTOWN, N. Y.

NEW YORK CITY

**Ball Bearings with Exceptionally Large Load Capacities  
Bearings of Annular Type for Combined Radial and Thrust Loads**

## Highest Load Capacities

Gurney Ball Bearings have higher load capacities than any other ball bearing because they carry a greater number of large sized balls in a continuous raceway accurately ground, so that the race contour follows closely the contour of the ball. This accurate grinding of raceways gives an increased area of contact between ball and race, and so reduces contact stress.

*Send for our catalog and compare Gurney load ratings with the ratings of other makes of ball bearings.*



## Eliminate Separate Thrust Bearings

Every ordinary thrust bearing must be provided with some kind of radial bearing to keep the shaft in alignment. The Gurney Radio-Thrust Bearing carries any desired proportion of radial and thrust load on a single row of balls, and obviates the necessity for separate radial and thrust bearings. Our Bulletin G-1 explains and illustrates the application of this type of bearing to more than twenty different types of machinery.

## Authoritative Engineering Advice

To make sure that Gurney Bearings will give maximum service, we have a Service Engineering Department which advises the proper types and sizes of bearings to be used, and designs suitable mountings, dirt seals, etc. These Engineers are specialists in this work and we guarantee the satisfactory operation of bearings installed according to their recommendations.

Whenever you have a troublesome bearing problem of any kind, give these Engineers a chance to help you solve it. Sketches or blue prints of the design with load and speed data will enable them to work intelligently and make positive recommendations.



# GURNEY BALL BEARING COMPANY

Conrad Patent Licensee

CHICAGO, ILL.

JAMESTOWN, N. Y.

NEW YORK CITY

**Ball Bearings with Exceptionally Large Load Capacities  
Bearings of Annular Type for Combined Radial and Thrust Loads**

## An Interesting and Successful Application of Gurney Bearings

The spindle of this vertical grinder is mounted throughout on Gurney Bearings.

When running idle, the weight of the spindle and grinding wheel is carried on the Radio-Thrust Bearing mounted in the upper part of the main headstock.

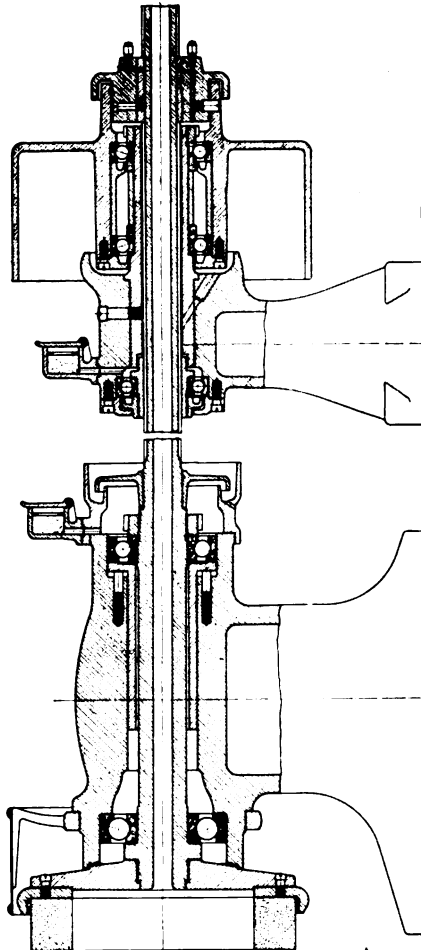
When grinding, the large Radio-Thrust Bearing carries the heavy upward thrust, due to the pressure of the wheel upon the work, and also carries all radial loads, due to torque and side thrust.

The radial bearing in the center holds in alignment the upper part of the spindle and the driving collar at the top.

The two bearings which carry the driving pulley and take all of the belt pull, are mounted on a sleeve outside the spindle, so that the spindle is not subjected to any bending stresses, as it receives from the pulley only torque loads.

The full line of Pratt & Whitney surface grinders are mounted in this manner on Gurney Bearings.

If our Engineers can help solve Pratt & Whitney's bearing problems, it is more than likely that their suggestions will be helpful to you. Gurney bearings are made to carry loads up to 32 tons on a single bearing.



Showing Application of Gurney Bearings  
to Vertical Surface Grinder

# THE HESS-BRIGHT MFG. COMPANY

PHILADELPHIA, PA.

**Manufacturers of Annular and Thrust Ball Bearings**

## HESS-BRIGHT BALL BEARINGS

**are successfully used  
whenever it is desired to minimize  
friction and reduce wear**

Special literature on request, describing various applications.

Aside from the economy in power which they make possible, Hess-Bright Ball Bearings effect important savings in repair and upkeep charges, due to the fact that wear is virtually absent.

## ANNULAR BEARINGS



Made regularly in sizes up to 110 mm. (4.3307 inches) shaft diameter. Special sizes to order if quantity is sufficient.

Three series: "Light," "Medium," "Heavy." Thus for a given bearing bore or shaft size, a choice between three sizes of bearings of increasing capacity and ball diameter is afforded.

Hess-Bright Annular Bearings are so constructed that the sides of the races are unbroken. This fact has an important bearing on durability.

## THRUST BEARINGS



**Thrust Bearings**

Made regularly in sizes up to 105 mm. (4.1339 inches) shaft diameter. Larger sizes on special order.

Two series: "Medium" and "Light."

One-direction and two-direction types with or without aligning washers, though the use of such washers is recommended.

Annular Bearings are capable of carrying considerable thrust load, amounting in the deep groove or Monarch type to about 25 per cent. of their rated radial capacity. Where it seems desirable to subject annular bearings to thrust load, it is advisable to consult with the bearing manufacturer.

# HYATT ROLLER BEARING COMPANY

NEWARK, N. J.

Manufacturers of Roller Bearings



Solid  
Outer Race



Roller  
Assembly



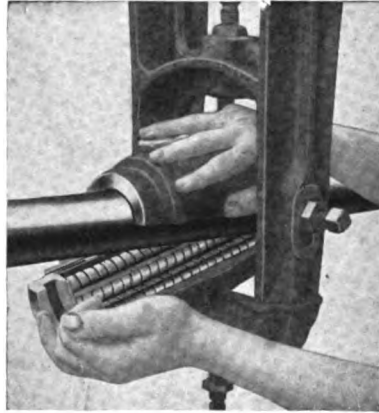
Split  
Outer Race

## HYATT ROLLER BEARINGS

The essential parts of the Hyatt Bearing are the spiral rollers. These rollers are wound from strips of special-analysis chrome vanadium steel and then carefully ground to close limits. Since the rollers are hollow, they can accommodate a sufficient supply of lubricant to last for periods of from three to four months. This lubricant is distributed back and forth over the bearing surfaces by means of the left and right hand spiral slots in the rollers.

Hyatt Roller Bearings have been used with remarkable success in the following applications: Textile machinery, machine tools, countershafts, pulleys and idlers, gear boxes, mine cars, automobiles, tractors, industrial trucks, railway service cars, charging and ingot cars, rolling tables, electric motors, cranes and hoists, etc., etc., etc.

A series of engineering bulletins has been prepared covering a great many of these applications. These bulletins give general engineering information concerning the installation of Hyatt Roller Bearings and include the speed and loads under which the bearings give ideal service.



Note Simple Installation

## LINE SHAFT BEARINGS

The Hyatt Roller Bearing for Line Shafting is also built around the spiral steel rollers which assure a permanent full line contact along the entire bearing surface. The Hyatt Line Shaft Bearing is split, making installation exceedingly simple. The automatic distribution of lubricant by means of the spiral slots in the rollers makes frequent oiling unnecessary. The Hyatt Line Shaft Bearing is both durable and dependable. It has proven its ability to reduce power losses and lubrication costs. Bulletin 122 contains engineering information and gives a complete list of sizes.

The following list shows a few of the popular sizes carried in stock:

### LIST OF STANDARD SIZES

DIA. SHAFT	DIA. SHAFT	DIA. SHAFT
1 1/4"	2 1/4"	3 1/4"
1 1/2"	2 3/4"	3 3/4"
1 3/4"	3 1/8"	
2"	3 1/2"	

# THE NEW DEPARTURE MFG. CO.

BRISTOL, CONN.

Conrad Patent Licensee

Western Branch  
818-20 Ford Building  
DETROIT, MICHIGAN

Distributors  
in all Trade Centers  
of the United States

For Continental Europe  
Jacob Holst  
COPENHAGEN, DENMARK

Sole British Agents  
Brown Bros., Ltd.  
LONDON-MANCHESTER

## NEW DEPARTURE

Double Row

Single Row



## BALL BEARINGS

Radax

Magneto

**American Made for American Trade**



Double Row

THE DOUBLE ROW is a distinctive, dual-purpose, self-contained unit, developed, patented and guaranteed by this Company. It has two sets of balls and raceways, mounted in such relation that radial loads and end thrusts, singly or combined, are successfully resisted.



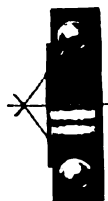
Single Row

THE SINGLE ROW, in diameter, width and bore, is Internationally standardized and, therefore, interchangeable with other makes of bearings of this type. Maximum number of large balls, improved separator. A strictly radial bearing.



Radax

THE RADAX, a cup and cone bearing with angular load line of  $35^\circ$  from normal. For use where one direction thrust is present, either singly or combined with radial load. In dimensions it is interchangeable with corresponding sized single row annular bearings.



Magneto

THE MAGNETO, designed to carry light loads at high speeds. Due to the design of the races and slight angular contact line, it will sustain light end thrusts as well as radial loads, and is noiseless in operation.



**Made in a large variety of sizes: Absolutely guaranteed: Unexcelled Service.**

*Send for a set of our Engineering Data Sheets.*

# THE NORMA COMPANY OF AMERICA

1790 BROADWAY, NEW YORK, N. Y.

"Norma" Ball, Roller, Thrust and Combination Bearings

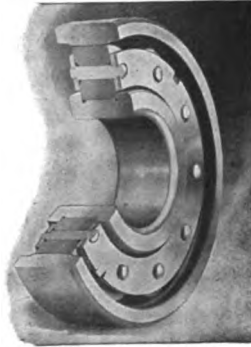
## "NORMA" BALL BEARINGS

Open type, separable bearings of extremely high precision, rigidly mounted, silent running, with every element in workmanship and design contributing to high efficiency, long-time service; notably successful in high-speed operation, being the standard bearings with most of the leading manufacturers of high-speed electrical apparatus.



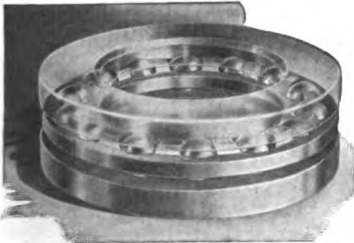
## "NORMA" ROLLER BEARINGS

Heavy-duty, high-efficiency bearings preëminently adapted for service where shock, jar, vibration and sudden load variations must be encountered; double the load capacity of a ball bearing of the same dimensions; temporary overload capacity up to 50 per cent of their own rating; high-speed, quiet-running units of extreme precision and maximum durability.



## "NORMA" THRUST BEARINGS

Precision units affording maximum anti-friction efficiency under end thrust loads; designed to afford long-service durability and silent-running qualities; made in several styles, single and double, both without housings and with housings of several types giving self-contained advantages.



## "NORMA" COMBINATION BEARINGS

Self-contained units affording perfect adjustment and maximum anti-friction efficiency under combined radial and thrust load; two types—combined annular and ball thrust, and combined roller and ball thrust; distinguished by high precision, open-type construction, rigid mounting, silent-running and high-speed qualities.



Send for the complete catalog  
"Norma Precision Bearings."

# ROYERSFORD FOUNDRY AND MACHINE CO.

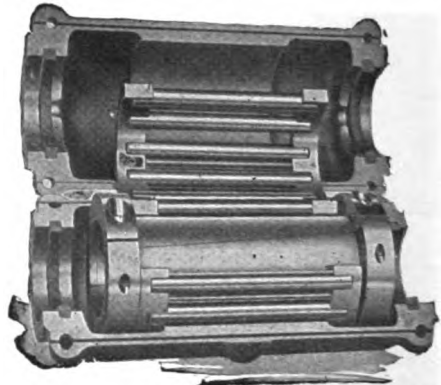
52 N. 5TH St., PHILADELPHIA, PA.

Manufacturers of Roller Bearings and other Power Transmission Machinery

## SELLS ROLLER BEARINGS

### Installation

Ease of installation is one of the prime advantages of "Old Reliable Sells Roller Bearings." Every Sells Roller Bearing fits practically every standard drop hanger, post hanger and pillow block. The split construction of Sells Roller Bearings—which will be discussed later—fits every Sells Roller Bearing to three different shaft sizes. Installation is simpler than with babbitted bearings and can nearly always be made over night.



"Sells" Roller Bearing Boxes  
With Single Roller Structure  
For Line Shafts and Counter Shafts

Sells Roller Bearings Reduce Friction  
and Save Shaft Wear

A close, five-minute study of the accompanying illustration will show you plainer than words why the all-split, quick-applied "Sells" is the foremost, friction-reducing, shaft-saving bearing on the market.

### Old Reliable Sells Roller Bearings

Note the split steel bushing that protects the shaft, the collars that clamp it fixedly to the then-protected shaft. See also the split roller structure; how it separates the rollers, eliminating roller-against-roller frictions. It holds the rollers parallel to the shafting and each other. Friction is obviously eliminated at every point because the bearing is of the full floating type.

### The Split Box

The split box is made of a special composition, carefully machined. It is split with a milled tongue-and-grooved joint and the halves are bolted together.

When the bearings are applied the roller cages are greased thoroughly and additional grease can be applied through an opening on the top half of the box whenever necessary.

Size of Shaft Inches	Price	L'gth Inches	Width of Box Inches	Height of Box Inches	Code
1/2" & 1"	\$3.00	6 3/4"	2 1/2"	2 3/4"	Ibex
1/2" & 1 1/4"	3.50	6 1/2"	3"	3 1/4"	Ice
1/2" & 1 1/2"	4.00	7 1/4"	3 1/4"	3 1/2"	Idea
1/2" & 1 3/4"	4.75	8"	3 3/4"	4"	Idiot
1/2" & 2"	5.50	8 3/4"	3 3/4"	4 1/4"	Idol
2 1/4" & 2 1/2"	6.75	9 1/4"	4 1/4"	5 1/4"	Ignite
2 1/2" & 2 3/4"	7.75	10 1/4"	4 3/4"	5 3/4"	Ilk
2 3/4" & 3"	9.50	10 3/4"	5 1/4"	6 1/4"	Image
3" & 3 1/4"	11.25	11"	5 3/4"	6 3/4"	Imbibe
3 1/4" & 3 1/2"	17.25	11 3/4"	5 3/4"	6 3/4"	Immerse
3 1/2" & 3 3/4"	19.25	12 3/4"	6 1/4"	6 3/4"	Impose
3 3/4" & 4"	33.50	14 1/4"	6 1/4"	7 1/4"	Imposter
4" & 4 1/4"	38.50	15"	7 1/4"	7 3/4"	Improve
4 1/4" & 4 1/2"	44.00	15 1/4"	7 3/4"	8 1/4"	Inapt
4 1/2" & 4 3/4"	50.00	16 1/4"	8"	8 3/4"	Inca
4 3/4" & 5"	56.50	16 3/4"	8 1/4"	8 3/4"	Incense
5" & 5 1/4"	64.00	17"	8 3/4"	9 1/4"	Income

Heavy Duty "Sells" Roller Bearing Boxes  
With Double Roller Structures  
For Main or Jack Shafts and Heavy Belt Pulls

Size of Shaft Inches	Price	L'gth Inches	Width of Box Inches	H'ght of Box Inches	Code
1 1/2" & 2"	\$9.50	13"	3 1/2"	4 1/4"	Impound
2 1/4" & 2 1/2"	11.75	13 1/4"	4 1/4"	5 1/4"	Imprint
2 1/2" & 2 3/4"	13.25	14 1/4"	4 3/4"	5 3/4"	Inarch
2 3/4" & 2 3/4"	16.25	15 1/4"	5 1/4"	6 1/4"	Inborn
2 3/4" & 3"	19.50	15 3/4"	5 3/4"	6 3/4"	Inbred
3 1/4" & 3 1/2"	29.50	17 1/4"	5 3/4"	6 3/4"	Inclose
3 1/2" & 3 3/4"	33.00	17 1/2"	6 1/4"	6 3/4"	Incog
3 3/4" & 3 3/4"	47.00	19 1/4"	6 1/4"	7 1/4"	Indeed
3 3/4" & 4"	55.00	19 3/4"	7 1/4"	7 3/4"	Indent
4 1/4" & 4 1/4"	63.00	21"	7 1/4"	8 1/4"	Index
4 1/4" & 4 1/2"	70.00	21 1/4"	8"	8 1/4"	Indigo
4 1/4" & 4 3/4"	80.50	22 3/4"	8 1/4"	8 3/4"	Induce
4 3/4" & 5"	89.50	24"	8 3/4"	9 1/4"	Infant
5 1/4" & 5 1/2"	115.00	24 3/4"	9 1/4"	10"	Increase
5 1/2" & 6"	158.00	26 1/2"	10 1/4"	11 1/4"	Incrout



## ROYERSFORD FOUNDRY AND MACHINE CO.

### We Guarantee

a reduction in the friction load of from 25% to 50% which will more than pay for the cost of substitution each year. Let us give you specific instances of savings in production, with figures and signatures.

### ROLLERINE



the life of the bearings insured under normal conditions of line-shaft service. Write for free sample.

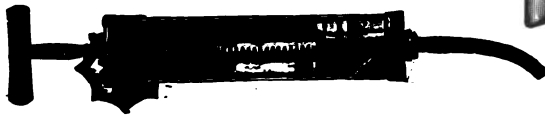
"ROLLERINE" is compounded expressly for the lubrication of "Sells" Roller Bearings and is the best lubricant for all roller and ball bearings. "Rollerine" contains 97% of lubricating properties and less than  $\frac{1}{4}\%$  residuum.

When "Rollerine" is used to lubricate "Sells" Bearings, maximum efficiency is obtained, and

### "SELLS" OIL-AND-GREASE GUN

The "Sells" Gun affords the most efficient means for applying "Rollerine" to "Sells" Roller Bearings. It is also adapted for heavy oils and greases of all kinds.

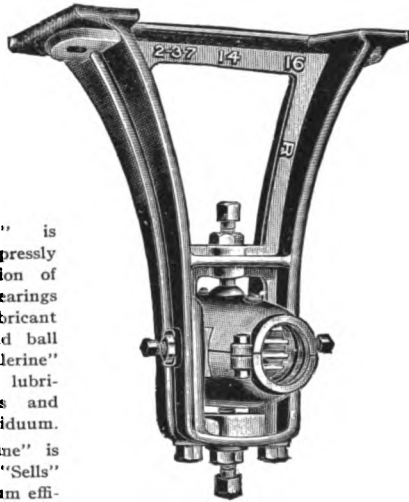
The hand wheel operating a pinion meshing in the rack makes it easy to control the amount of lubricant forced out. Its economy is very apparent. A curved nozzle adds to the convenience in applying the lubricant.



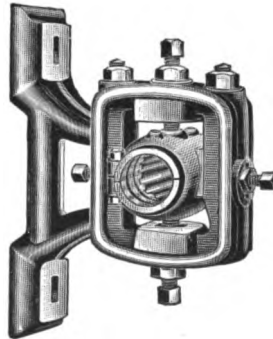
"SELLS"  
Oil-and-Grease Gun

All parts brass except the steel pinion and malleable iron hand wheel.

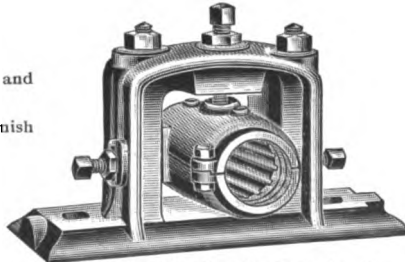
Workmanship and material first class. Finish throughout, high grade.



The "Sells" Roller Bearing  
Drop Hanger



The "Sells" Roller Bearing  
Post Hanger



The "Sells" Roller Bearing Floor Stand

## S K F BALL BEARING CO.

HARTFORD, CONN.

Self-Aligning Radial, Adapter and Thrust Ball Bearings; and Self-Aligning Shaft Hangers and Pillow Blocks



### S K F Radial Ball Bearings

have the exclusive feature of self-alignment, possessed by no other ball bearing. The inner surface of the outer race is a section of a hollow sphere whose center is on the axis of the shaft. The inner race and balls are free to turn in any position within the race—a true ball and socket action. Thus, any deflection or springing of the shaft does not bind the bearing; the bearing compensates for this deflection.

### S K F Thrust Bearings

Single or Double Thrust with flat seats. Single or Double Thrust with spherical seats and aligning washers, making a self-aligning thrust bearing. Also, an exclusive S K F type known as the self-contained, self-aligning double thrust bearing. This bearing is very simple to mount, carries all thrust loads and is at the same time self-aligning, compensating for deflection of the shaft.

### S K F Transmission Equipment

For transmission equipment the S K F Adapter Bearing is mounted in an oil-tight, dust-proof housing and held in drop hanger, post hanger or pedestal pillow block. A rigid pillow block is also made, in which the pillow block itself houses the bearing.

No machining of the shaft is necessary



Shaft Hanger

in mounting the S K F Adapter Bearing. The bore of the inner race is tapered, and fits on a conical split sleeve. This sleeve is simply slipped over the shaft, the bearing is drawn in place on it and a lock nut holds the bearing firmly in position on the shaft.

*Special catalogs, literature or information gladly furnished for any application.*

# U. S. BALL BEARING MFG. CO.

(Conrad Patent Licensee)

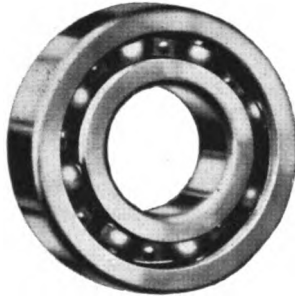
PALMER STREET AND KOLMAR AVENUE

CHICAGO

ILLINOIS

## BALL BEARINGS

Of any type, for every purpose and of any size,  
but only one quality—the highest



U. S. Ball Bearings are made in the following types:

Radial Type

Plain Thrust Bearings

Cup and Cone Type

Grooved Thrust Bearings

Combination Double-Action  
Bearings

Double Direction Thrust  
Bearings

## U. S. Standard Materials

**Steel**—All U. S. bearings are made of a special chrome carbon alloy steel, one the analysis of which we have found to be best adapted for this special work. Each bar of steel must pass our test for chemical and physical properties.

**Balls**—All balls used for U. S. bearings are of highest quality chrome alloy steel, and to pass our rigid inspection must be true to size and spherical within one ten-thousandth part of an inch.

**Retainers**—Our retainer or cage is made up of two corrugated steel members riveted together. This gives an ideal retainer, theoretically and practically correct; flexible and sturdy, directing the balls at the axis of rotation with the least possible friction.

## Engineering Service

Our Engineering Department comprises a staff of ball bearing experts, and is always at your service. It is our desire that if at any time they may be of service to you, and help you to solve your bearing problems, you will feel at liberty to call upon them.

*Our Catalogue F gives a complete list of bearing sizes, dimensions, etc. Send for it.*

## STANDARD ROLLER BEARING CO.

PHILADELPHIA, PA.

SALES OFFICES

1852 Penobscot Bldg., DETROIT, MICH.

2206 So. Michigan Ave., CHICAGO, ILL.

822 Hume Mansur Bldg., INDIANAPOLIS, IND.

SERVICE SALES DEPT. BRANCHES

163 Mass. Ave., BOSTON, MASS.

2206 So. Michigan Ave., CHICAGO, ILL.

Manufacturers of S. R. B. Maximum Type Annular Ball Bearings (Single Row and Double Row), S. R. B. Improved Type Taper Roller Bearings, "Standard Alloy" Steel Balls, Rudge-Whitworth Detachable Wire Wheels

### S. R. B. ANNULAR BALL BEARINGS

It is a fact and has been proven by conclusive tests for strength and endurance that S. R. B. Bearings are superior to any bearings made in America.



There are three fundamental principles upon which we base this claim of superiority, namely:

1st. Accuracy of chemical composition of the steel used in their manufacture.

2nd. Accuracy of heat treatment which produces the correct physical structure in the steel.

3rd. Accuracy of mechanical execution in the grinding and fitting of all the component parts.

We stand ready to prove these assertions.

S. R. B. Maximum Type Silent Annular Ball Bearings are so called because no other name is so appropriately descriptive; maximum, because they contain the greatest number of balls possible to put into a bearing of this type; silent, because they are positively noiseless.

They are capable of sustaining greater thrust loads than other annular ball bearings because of four specific points of merit in their design and workmanship:

1st. Deep ball groove in races.

2nd. Large diameter balls.

3rd. Maximum number of balls.

4th. Accurate and snug fitting assembly.

S. R. B. Bearings are interchangeable with all other makes of annular ball bearings, either domestic or foreign; comparative table (form 9032) showing the most commonly used sizes will be sent upon request.



It has been frequently demonstrated that under some conditions one type of bearing works a tremendous saving over another. Certain other conditions sometimes develop which make one type of bearing impractical for the use intended. Under certain load conditions, a smaller bearing can be used very often with the same satisfaction and service as the larger one. Sometimes by making a slight change in application, according to the bearing maker's point of view, greater efficiency can be obtained.

## STANDARD ROLLER BEARING CO

You will find us always ready to solve such problems without bias and without charge, and we particularly urge the importance of consulting our Engineering Department in selecting bearings for any mounting. You will find our engineers qualified by training and experience to give expert advice on such problems, and by submitting your plans to us, sending if possible blueprints or sketches showing the application and giving complete information regarding speed, load and shaft size, you can be assured that most satisfactory results will be obtained.

**S. R. B. Bearings** are made to do their work with masterful efficiency.

### **S. R. B. Improved Type Taper Roller Bearing**

We have designed, tested and are now proceeding to manufacture Taper Roller Bearings in accordance with an improved scheme of construction representing a radical departure as regards shape of rollers and cone from the design of any bearing which has so far appeared on the market. This improved bearing possesses these advantages:

1. The parts are simpler to manufacture, so that they can be gauged very accurately and all the component parts of the bearing will be made more nearly interchangeable than it has before been considered possible to make.
2. When constructed of the same quality of steel as the same size bearing of a competitor's manufacture, the new design will display four times the endurance and life which the other designs can yield. But when constructed of our superior analysis and correctly heat-treated steels, the load sustaining capacity of our new design bearing is still further improved.
3. This improved bearing while under load requires the application of one-quarter or one-fifth the torque to set the bearing spinning. This is also an indication of the relative frictional resistance of the new and old type bearings.
4. The cone and the cage elements of the rollers are made as a self-contained unit. The rollers and cage are, however, very easily separable from the cone as occasion may arise for inspecting and cleaning the bearing surface of the cone.



187

### **"STANDARD ALLOY" STEEL BALLS**

The increasing use of steel balls for anti-friction Bearings has created a demand for balls of the greatest crushing strength combined with durability and great accuracy. After exhaustive investigations on the subject of alloy steels and the effects of various heat treatments on such steels, we are offering our Standard Alloy Steel Balls, which by actual tests have been shown to have a crushing strength approximately  $33\frac{1}{3}\%$  greater than that of the best foreign balls of equal size. Standard Alloy Balls are made from a special chrome alloy steel, made exclusively for us and particularly adapted for the service to which these balls are subjected. The greatest care is exercised in the various processes of manufacture, including the heat treatment and inspection. Standard Alloy Balls are gauged three times as to their accuracy in diameter and sphericity before shipment, and are guaranteed to have a commercial accuracy of within .0001". Their surfaces are absolutely free from any tool marks or flaws in material.

# THE GWILLIAM COMPANY

Engineers

NEW YORK: 253 W. 58TH ST. AT BROADWAY

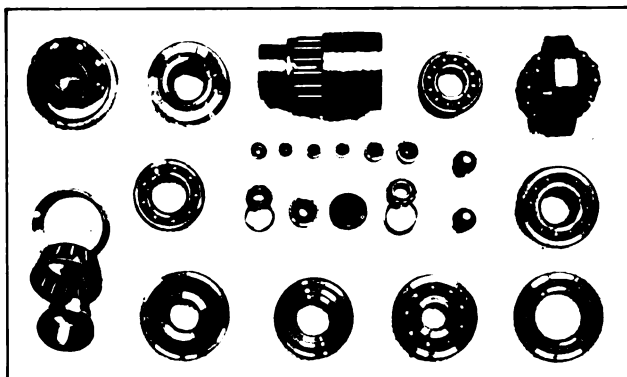
'PHONE: COLUMBUS 8356

PHILADELPHIA: 1314 ARCH ST., 'PHONE: WALNUT 3497

## BALL AND ROLLER BEARINGS

English (Inch) and Metric Dimensions

Types of Bearings in Stock or To Order



Annular Ball Bearings  
(English Ball Journal)  
Single and Double Row

Ball Thrust Bearings  
All Types

Journal Roller Bearings

Taper Roller Bearings  
Standard

Roller Thrust Bearings

Pressed Steel Bearings  
All Types



# THE G WILLIAM COMPANY

Sole U. S. Distributors for Bowden Wire, Ltd., England

NEW YORK: 253 WEST 58TH ST.

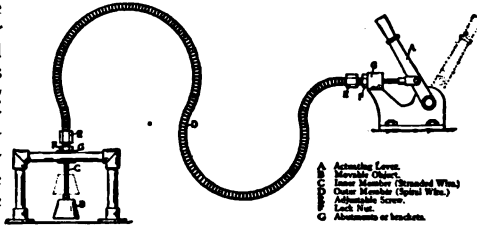
PHILADELPHIA: 1314 ARCH ST.

## BOWDEN PATENT WIRE MECHANISM

Bowden Wire Mechanism consists mainly of two parts—a closely coiled and practically incompressible spiral wire, constituting what is termed “the outer member,” and a wire cable, practically inextensible, threaded through the above, and termed “the inner member.”

**What It Does:** The Bowden Wire Mechanism dispenses with all the difficulties of the usual mechanical method of transmitting power in other than a straight line, while enabling power to be transmitted by a tortuous route. The Mechanism is complete in itself, and requires only that one member shall be anchored to a stop at each end, and that the other member shall be attached to an operating lever at one end and to the object to be moved at the other.

**How It Operates:** It will be seen that the ends of the *inner* member may be anchored, and the outer member then used as the medium for a *pushing* motion; or that neither member need be fixed in a stationary sense, but only fixed relatively to each other, so that while one pulls the other pushes, relative displacement thereby ensuing.



The Principle Illustrated

**Styles of Finish:** There are five styles of finish—Bowdensilver and Bowdenbrass, Bowdenite, Bowdenoir, Bowdensolo, and Bowdenamel. In BOWDEN-SILVER and BOWDENBRASS the outer member of the Wire Mechanism is first covered by the patented waterproof material and then armoured or wrapped with German silver and brass ribbon, respectively. BOWDENITE is of the same waterproof material, but finished with a black, polished surface. In BOWDENOIR the outer member of the Wire Mechanism is oxidized to a gun-barrel finish; in BOWDENAMEL it is enamelled; while in BOWDENSOLO the outer member is merely tinned.

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Bowdensolo



Bowdenoir



Bowdenite



Bowdensilver and Bowdenbrass



Bowdenamel

## ADAPTED THROUGHOUT THE WORLD TO

Airship and Aeroplane Controls  
Auxiliary Air Regulators for Gasolene Motors  
Brakes for Cycles, Motor Cycles, Cycle Cars and Motor Cars  
Brakes for Elevators  
Brakes for Military and other Heavy Vehicles  
Brakes for Trained Vehicles  
Carburetor Ticklers  
Change-Speed Gears for Cycles, Cycle Cars and Motor Cars

Controls for Electric Switches  
Handle-Bar Control for Motor Cycles  
Ignition and Throttle Control for Motor Cars and Motor Cycles  
Locking Devices for Elevator Gates  
Motor Boat Controls  
Muffler Cut Outs  
Sighting Mechanism for Naval Guns  
Sprags for Motor and other Vehicles  
Valve-Lifters for Motor Cycles  
Wireless Telegraphy Switchboards and many other purposes

Nearly Three Million Feet Sold Annually. Extensively Used in the American, British, French and Italian Navies and Aircraft.

# ATLAS BALL COMPANY

GLENWOOD AVENUE AT FOURTH STREET

PHILADELPHIA, U. S. A.

Manufacturers of Steel Balls for Bearings

## ATLAS STEEL BALLS

Accuracy

Uniformity

Quality

ATLAS BALLS are the recognized standard steel bearing balls of American manufacture, and the peer of any bearing ball in the world. Our constant efforts to perfect a product that our guarantee could cover without any exceptions have been appreciated by ball bearing, automobile and high grade machinery manufacturers who are the acknowledged leaders in their respective fields.



We have met the demand for a perfect ball—the Atlas process of grinding insures round balls of uniform accuracy.

190

The balls go through a process which includes forging, three stages of grinding, annealing, hardening and polishing, the nature of which produces balls of uniform cross-section, *hard clear through*, and absolutely accurate within .0001 of an inch.

We make one grade of balls only—the highest—and confine ourselves to that grade.

Chrome Alloy Steel of special analysis is used in making Atlas Balls. This steel is hardened clear through and is the very highest quality that can be used.



Atlas Balls stand the test of time, wear and of every known formula for determining quality and exactitude.

### *Important*

We guarantee accuracy to within one-tenth-thousandth of an inch to size. Every box is sealed and the contents will be found to be as represented.





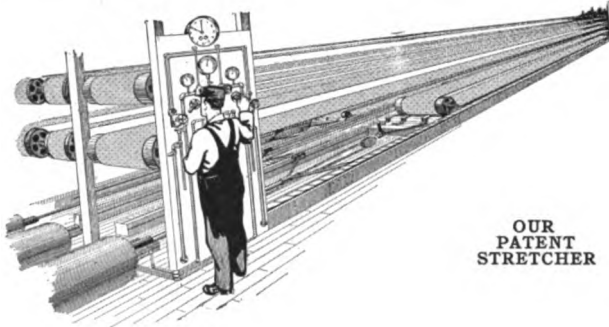
# H. N. COOK BELTING COMPANY

Established 1880

SAN FRANCISCO, CALIFORNIA, U. S. A.

Cable Address: Horatio

Manufacturers of Patent Stretched Leather Belting



We own and control patents covering process and machinery, shown as above, for testing and stretching leather belts. Briefly, these belts are laced on over a series of pulleys and operated under pneumatic tension, according to the width and thickness of the belt, with the view of not only testing the laps and other portions of the belt, but stretching it. We take out of our belts from 3 to 4 per cent on these stretchers and supply you with a belt that is practically worked down to its bearings.

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STOCK  
AND  
WORKMAN-  
SHIP

Belts listed herewith are all made from **CENTER CUTS** of **PURE OAK TANNED BELTING BUTTS** from which all shoulder and flank have been removed. Strips are all carefully sorted and fitted so as to make well-balanced belting. New lapping machines recently installed cut perfect splices which means uniform belting. Cementing is done under heavy Hydraulic Pressure after which our belting is submitted to our stretching process as shown above.

## **DOLPHIN WATERPROOF CEMENT PATENT STRETCHED BELT**

*Made in all weights.*

*For damp and wet places.*

The cement with which this belting is made not only resists moisture, but heat and oil as well.

OUR  
BRANDS  
FIRST  
QUALITY  
BELTING  
AND  
HOW  
USED

## **GOLDEN STATE PATENT STRETCHED BELT—EXTRA HEAVY**

We make an **EXTRA HEAVY** single belt in this grade, which can be used where it is not practical to use a double belt, and where more than an ordinary single belt is required. We also make a **DOUBLE** belt in this grade measuring about  $\frac{1}{4}$ " thick, which is sometimes used in place of a three-ply belt, particularly where the pulleys are not large enough for three ply. We also make this belt in three ply for extra heavy drives.

## **GOLDEN STATE PATENT STRETCHED BELT—HEAVY**

The single belts in this weight are used for all ordinary purposes. The double belts are used where pulleys are of fair size and where the belt is called upon to do heavy duty. Three-ply belts of this grade are particularly adapted for **MAIN DRIVES**.

**PROGRESS PATENT STRETCHED BELT** is a **MEDIUM WEIGHT** belt. The single is adapted for most any drive. It is made of the same quality of leather as the above, only it has not quite the body. The Doubles are adapted for medium diameter pulleys and medium speeds. The three plies are particularly adapted for **HEAVY GENERATOR WORK**.

**GOLDEN STATE DYNAMO PATENT STRETCHED BELT**—for **Dynamos** and **High Speeds**. It is made principally in doubles.

PRICES

**PRICE LIST.**—We sell on the standard list, which is figured on a twenty-four cent basis for belt one inch wide by a foot long—thus belt 10" wide would list 10 X 24 or \$2.40. Double belts are twice the price of single and three-ply belts are three times the price of single. Prices of the above grades vary according to weight. In other words, light belting is sold at a cheaper price than medium or heavy, etc. The prices are governed by discounts which we will quote on application.

CORRESPONDENCE IN SPANISH AND RUSSIAN.

# THE GRATON & KNIGHT MFG. CO.

Oak Leather Tanners and Belt Makers

WORCESTER, MASSACHUSETTS, U. S. A.

Atlanta, Ga.  
Boston, Mass.  
Chicago, Ill.  
Cleveland, O.

Detroit, Mich.  
Fall River, Mass.  
Kansas City, Mo.  
Minneapolis, Minn.

New York, N. Y.  
New Orleans, La.  
Philadelphia, Pa.  
Pittsburgh, Pa.

Portland, Ore.  
St. Louis, Mo.  
Seattle, Wash.  
Leicester, England

## SELLING AGENTS

Graton & Knight Mfg. Co. of Texas, Dallas, Tex.

Graton & Knight Mfg. Co. of Wisconsin, Milwaukee, Wis.

Graton & Knight Mfg. Co. of California, San Francisco, Cal.

## LEATHER—LEATHER BELTING—LACE LEATHER—BELT CEMENT—BELT DRESSING

Packings—Strappings—Automobile Leathers

Solid and Twist Round Belting—Block and Link Type "V" Belts

## BELTING

**Spartan Belting** is made in all plies from specially tanned leather to withstand the effect of steam, water, oil, heat, gas and acid fumes. It is unusually pliable, and possesses great tensile strength—a belt specially recommended for difficult drives.

**Neptune** and **Special Planer** are Waterproof Belts, made from center stock of the choicest Oak Tanned Leather. Neptune is made in all plies. Special Planer is made only in extra heavy single and not over 4" in width.

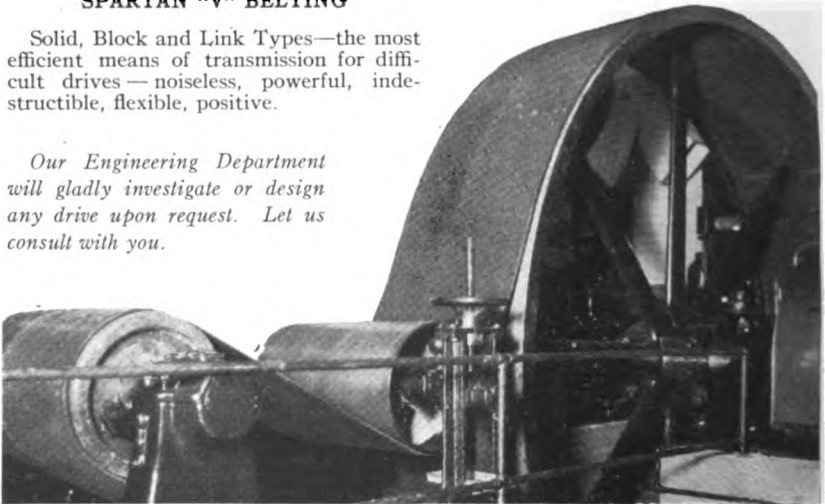
**Heart**, **GraKnight** and **GraKnight Dynamo** are all brands of strictly first quality belting, cut from center stock of the choicest Oak Tanned Leather. These three brands differ only in the weight and consequent thickness of the leather used in their construction. The Heart and GraKnight are made in all plies, while the GraKnight Dynamo is furnished principally in doubles.

**Extra Short Lap** and **Pryzoak** are what we term second quality brands of belting. They are cut from a good selection of side stock Oak Tanned Leather, and differ only in the weight of the leather used in their construction. Both brands are made in single and double ply and not over 6" in width.

## SPARTAN "V" BELTING

Solid, Block and Link Types—the most efficient means of transmission for difficult drives—noiseless, powerful, indestructible, flexible, positive.

*Our Engineering Department will gladly investigate or design any drive upon request. Let us consult with you.*



# CHAS. A. SCHIEREN COMPANY

Established 1863

Tanners—Belt Manufacturers

30-38 FERRY STREET, NEW YORK

ATLANTA, GA., 272 Marietta St.  
BOSTON, 232 Summer St., Op. So. Station  
CHICAGO, 128 W. Kinzie St.  
CLEVELAND, 777 Rockwell Ave.  
DALLAS, TEX., The Texas Chas. A. Schieren  
Co., Inc., 205 So. Market St.  
DENVER, 1752 Arapahoe St.  
DETROIT, 72 Congress St., West

KANSAS CITY, 1324 W. 12th St.  
MEMPHIS, TENN., 475 So. Main St.  
NEW ORLEANS, LA., 404-406 Canal St.  
PHILADELPHIA, 226 North Third St.  
PITTSBURGH, 337 Second Ave.  
SALT LAKE CITY, 115 W. 2nd So. St.  
SEATTLE, WASH., 305 First Ave., South  
ST. LOUIS, 18 So. Broadway  
OAK LEATHER TANNERIES, Bristol, Tenn.

## DISTINCTIVE SCHIEREN BELTINGS

All of the finest quality, but selected to fill different requirements and guaranteed to do the work for which each is intended.

Each belt is stamped every ten feet with its Trade Mark and the Chas. A. Schieren Company signature, which assures a full guarantee of workmanship and material.

*Chas. A. Schieren Company*  
SIGNATURE

## DUXBAK LEATHER BELTING

To Schieren belongs the credit of making the one leather belt which successfully meets the demands of belt users the world over. No matter where you may be located, whether in the far East, West, in the South or North, or what you may think a perfect belt should do, you are justified in specifying "DUXBAK" Waterproof Leather Belting.



Reg. U. S. Pat. Off.

Duxbak is of two kinds, **Waterproof** and **Steamproof**, not approximately, but absolutely, and is used for all belting purposes.

The **Waterproof** belt is for use in wet places where temperature does not exceed 140 degrees Fahrenheit.

The **Steamproof** belt is for use in live steam and all places where moisture is accompanied with extreme heat; also where belt is exposed to acid fumes or strong alkalies.

Cut from the backbone portion of oak-bark-tanned leather, tanned in our own tanneries.

Every belt guaranteed.

## ROYAL EXTRA BELTING

For general mill work and where a high quality belting is essential.



## BULL'S HEAD BELTING

For heavy drives, such as Rolling Mills and wide belts for Main Drives.

*Interesting literature on the subject of belting may be had on request.*



# J. E. RHOADS & SONS

MAIN OFFICE: 12 NORTH THIRD STREET, PHILADELPHIA

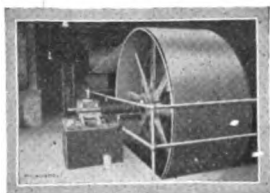
NEW YORK

CHICAGO

BALTIMORE

WILMINGTON

Manufacturers of Leather Belting, Flat and Round, Leather Belt Preserver  
Tanners of Tannate Belting Leather and Tannate Lace Leather



## RHOADS LEATHER BELTING

In Rhoads Belts you find strength and durability that are hard to equal. This saves you break-downs and loss from stoppage. They show comparatively little stretch, and are unusually true and even balanced. It is sold on the standard flat belt list.

## TANNATE LEATHER BELTING

In Tannate Flat Belting you find the above advantages, plus the remarkable toughness given by our Tannate tannage. Tannate takes strong grip on the pulley, reducing slippage to the lowest terms. It has remarkable power of resisting heat. Sold on standard flat belt list.



## LEATHER BELTING PRICE-LIST ADOPTED NOVEMBER 21, 1906

### Prices per Running Foot

1/2 in. .... \$ .12	3 1/4 in. .... \$ .78	11 in. .... \$2.64	21 in. .... \$5.04	40 in. .... \$ 9.60
3/4 " ..... .15	3 1/2 " ..... .84	12 " ..... 2.88	22 " ..... 5.28	42 " ..... 10.08
1 " ..... .18	3 3/4 " ..... .90	13 " ..... 3.12	23 " ..... 5.52	44 " ..... 10.56
1 1/4 " ..... .21	4 " ..... .96	14 " ..... 3.36	24 " ..... 5.76	46 " ..... 11.04
1 1/2 " ..... .24	4 1/2 " ..... 1.08	15 " ..... 3.60	25 " ..... 6.00	48 " ..... 11.52
1 3/4 " ..... .30	5 " ..... 1.20	16 " ..... 3.84	26 " ..... 6.24	50 " ..... 12.00
1 1/2 " ..... .36	5 1/2 " ..... 1.32	17 " ..... 4.08	27 " ..... 6.48	52 " ..... 12.48
1 3/4 " ..... .42	6 " ..... 1.44	18 " ..... 4.32	28 " ..... 6.72	54 " ..... 12.96
2 " ..... .48	6 1/2 " ..... 1.56	19 " ..... 4.56	30 " ..... 7.20	56 " ..... 13.44
2 1/4 " ..... .54	7 " ..... 1.68	20 " ..... 4.80	32 " ..... 7.68	60 " ..... 14.40
2 1/2 " ..... .60	8 " ..... 1.92		34 " ..... 8.16	64 " ..... 15.36
2 3/4 " ..... .66	9 " ..... 2.16		36 " ..... 8.64	68 " ..... 16.32
3 " ..... .72	10 " ..... 2.40		38 " ..... 9.12	72 " ..... 17.28

Double Belts List at Twice the Price of Single.

## TANNATE ROUND BELTING

For twenty odd years Tannate Round Belting has been outlasting ordinary belts from two to five times. Its remarkable grip permits easy drives, and its extreme strength gives unusual durability. It saves you take-ups and repairs. For clothing and shoe factories, it has all competitors beaten. It costs less in the long run.

## PRICES ON TANNATE ROUND BELTING

Revised December 7, 1916

In not less than	1/8	1/4	3/8	1/2	Reg. 1/4	Full 1/4	3/4	1	1 1/4	1 1/2	1 3/4	2
1000 ft. lots	30.75	36.30	41.25	43.35	44.00	55.90	73.35	96.50	131.50	153.40	184.00	214.75
Per 1000 ft.												263.12
500 ft. lots												
Per 100 ft.	3.25	3.95	4.20	4.45	4.65	5.90	7.50	10.00	13.90	16.00	19.00	22.25
100 ft. lots												
Per 100 ft.	3.50	4.20	4.35	4.80	4.90	6.15	7.90	10.65	14.60	16.85	19.70	23.00
Per foot	5c	5 1/4 c	5 1/2 c	5 3/4 c	5 3/4 c	8c	9c	12c	16c	19c	23 1/2 c	28c
												32c

The above prices are made only when the quantities specified are ordered for shipment at one time.

The quantities may be made up of different sizes. These prices are strictly net

## J. E. RHOADS & SONS

### TANNATE LACE LEATHER

Tannate Lace Leather lasts from three to five times as long as ordinary raw-hide. It keeps tough and flexible; and it does not break until it wears out. It saves you labor of lacing and the labor costs more than the lace. It increases output and costs less per year.

#### PRICES ON TANNATE LACE

Revised November 21, 1918

#### TANNATE CUT LACING

	$\frac{1}{4}$ in.	$\frac{3}{8}$ in.	$\frac{1}{2}$ in.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	$\frac{7}{8}$ in.	$\frac{1}{2}$ in.
In 1000 Ft. lots, per 100 ft.	2.20	2.60	3.05	3.45	4.00	4.90	5.95
In 500 Ft. lots, per 100 ft.	2.25	2.75	3.15	3.75	4.10	5.25	6.25
In 100 Ft. lots, per 100 ft.	2.35	2.85	3.30	3.85	4.30	5.45	6.55
Less than 100 Ft., per ft.	3 $\frac{3}{4}$ c	4c	4 $\frac{1}{2}$ c	5 $\frac{1}{4}$ c	5 $\frac{1}{2}$ c	6 $\frac{1}{2}$ c	7c

#### TANNATE LACE IN BACKS

Less than  $\frac{1}{2}$  dozen, at 80c per sq. ft.

$\frac{1}{2}$  dozen and over, at 75c per sq. ft.

The above prices are made only when the quantities specified are ordered for shipment at one time.

The quantities may be made up of different sizes.

These prices are strictly net.

### RHOADS LEATHER BELT PRESERVER

There is an ancient belt that has driven a Pennsylvania flour mill since 1882. This belt owes its green old age to having been treated with Rhoads Preserver for more than 20 years. Rhoads Preserver is highly beneficial to leather. It keeps belts pliable and strong, and gives them the hug and grip that promote maximum output. It reduces your belt bills.

#### NET PRICES

Adopted February 15, 1915

10 lb. cans	at 28c per lb.	50 lb. cans	at 25c per lb.
25 lb. cans	at 26c per lb.	Barrels and half barrels	at 20c per lb.

### RHOADS STICK BELT DRESSING

For belts that slip because of excessive load or other unusual conditions, use Rhoads Stick Belt Dressing. It promotes flexibility and gives a grip that keeps down slippage.

#### NET PRICES

Adopted February 15, 1915

1-lb. sticks	at 40c each
1 doz. 1-lb. sticks	at 37 $\frac{1}{2}$ c each
50 1-lb. sticks	at 35c each
3-lb. sticks	at \$1.10 each
50 3-lb. sticks	at 1.00 each

## SHULTZ BELTING CO.

ST. LOUIS, MO., U. S. A.

BRANCH: 111 Chambers Street, NEW YORK

**Manufacturers of Sable Rawhide Belting, Aqua Waterproof-Steam-Proof Belting, Oak Tanned Belting, Belt Dressing, Lace Leather, Etc.**

### SHULTZ SABLE RAWHIDE BELTING

Shultz Belting is made from the heaviest Packer Steer Hides, and the reason why this belting excels all others is because the leather is tanned by our own special process, and prepared from the raw material to the finished product under our own personal supervision.

SABLE Rawhide Belting is tanned on the surface—for contact, and the interior is rawhide—for strength. This, combined with its great strength and pliability, enables SABLE to hug the pulleys closer, transmit 25% more power, increase your production and outwear any oak tanned belt.



**This Is Easily Done with Sable Belting of  
Double Thickness**

### SHULTZ AQUA BELTING (Chrome Tan)

AQUA is an absolute Waterproof and Steam-proof Leather Belt. It is intended for laundries, dye houses, bleacheries, damp climates or any place where wet conditions exist.



**Reg. U. S. Pat. Off.**

Now here is where "Aqua" is different from other types of so-called waterproof belts. The waterproofing is tanned right in. It's waterproof on the surfaces and it's waterproof in the middle and remains waterproof under the worst conditions. You can boil a double in live steam and the plies will not separate or the leather lose its strength or pliability.

"Aqua" will outlast any rubber or canvas belt ever made and transmit from 25% to 33% more power.

#### Test Out

A SABLE Rawhide or AQUA Waterproof Belt on a 60-day "try-it-before-you-buy-it" basis. That is a mighty fair proposition, and it gives you an opportunity of letting your eyes be the judge, and your money the last thing you part with.



**TRADE MARK**

*Write for catalogue No. 10.*

# BOSTON BELTING COMPANY

84 LINDEN PARK ST., BOSTON

NEW YORK      BUFFALO      CHICAGO      SAN FRANCISCO      PORTLAND, OREGON  
100-102 Reade St.    90 Pearl St.    172 W. Randolph St.    55 First St.    105 First St.

**Manufacturers of Mechanical Rubber Goods: Belting, Hose, Packing, etc.**

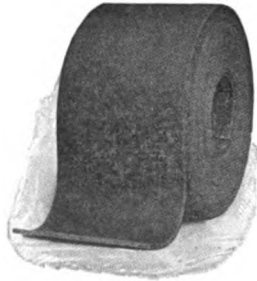
## TRANSMISSION BELTING

Rubber Belting is perfectly uniform in width and thickness. It is not readily affected by heat or cold and is well adapted for use in damp and wet places. It is strong, durable, grips the pulleys closely and does not slip.

**Brands**—Excelsior Red Frictioned, Imperial Stitched, Elmwood, Boston, Niagara, Trimount, Universal, Special Excelsior.

Adapted for all conditions of service; made from qualities and weaves of fabric and grades of rubber which assure maximum service and economy.

**Gutta-Balata Belting**—a high-grade textile belt, adapted for power transmission, also for conveying; so constructed that belts four-ply and heavier have absolutely seamless faces, and either side can be run next the pulleys; not injuriously affected by moderate quantities of oil or grease.



## CONVEYOR BELTING

Made all widths and thicknesses, with regular rubber cover, or extra thick rubber cover on one or both sides, and reinforced edges; adapted for use on straight or troughing pulleys, for carrying coal, ores, grain, gravel, sand and other materials.

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## HOSE

Rubber, for water, steam, gas, air, suction, oil and fire protection.

**Roxbro Braided Hose**, which is furnished in continuous lengths up to 500 feet, is especially recommended for pneumatic use.

**Cotton Hose**, rubber lined, furnished in light and heavy single fabrics and medium and heavy jacket fabrics for all kinds of fire protection equipment.



**PACKINGS**—sheet form, for flanges and joints; adapted for all conditions of service. Piston and valve rod packings, round, square and spiral; for hot and cold water and hydraulic purposes.

**RUBBER PUMP VALVES**—made in all shapes and sizes for different styles of pumps and various service conditions.

**RUBBER COVERED ROLLERS**. New Rollers Complete. Rollers Recovered.

High-grade coverings, made from selected gums; adapted for paper and textile mill uses, tanneries, tobacco factories, and every purpose for which rubber-covered rollers are used.

## NEW YORK RUBBER CO.

NEW YORK  
34 READE ST.

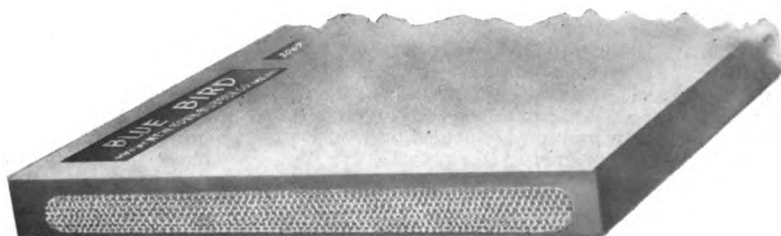
CHICAGO  
325 W. RANDOLPH ST.

**Manufacturers of Mechanical Rubber Goods**

### **"BLUE BIRD" CONVEYOR BELT**

LOW PRODUCTION cost means higher salaries

We GUARANTEE its ECONOMY



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Other Brands: "Gold Dredge," "Stonore," "Dependable." Stonore and Dependable made with special covers for varying service conditions.

### **TRANSMISSION BELTS**

**Triumph:** Friction surface. Fancy belt for permanent installation where initial outlay is not deciding factor.

**Wiccapee:** Friction surface. Recommended for main and important counter drives. *It has stood the test of Time.* Its installation insures economical transmission.

**Special Planer:** Friction surface. Made on light-weight Sea Island cotton with a high grade friction. The combination produces strength and flexibility essential on small pulley high-speed work.

**Our Extra:** Friction surface. A good belt for ordinary service.

Other Brands: "Tractor," Friction Surface; "Dutchess Stitched;" "Stacker;" "Cameo" and "Clinton" brands.

We also make hogscraper belts, axle generator belts, as well as special belts for any particular service.



# NEW YORK RUBBER CO.

---

## **"BLUE BIRD" AIR HOSE**

**No Wire to Remain Crushed**



*The celebrated ROPERAP construction with the abrasion resisting "BLUE BIRD" cover. Its wearing qualities insure ultimate economy.*

## **ROPERAP PNEUMATIC HOSE**

Illustration above serves to show construction. An economical hose for pneumatic tool service.

The "Dutchess" and "Cameo" brands made in the multiple construction.

## **STEAM HOSE**

"Roperap" Steam Hose has the advantages of armored hose of the ordinary construction without any of the drawbacks of wire winding. Recommended for severe service.

The "Dutchess" brand—a good hose for regular service.

## **WATER HOSE**

Rubber Fire Hose—"Blue Bird" brand. This hose carries the usual fire hose guarantee.

The "Dutchess" brand for the heavier pressures.

"Cameo" brand recommended for lighter service.

## **RUBBER PACKINGS**

Of all kinds and for all uses.

# THE B. F. GOODRICH CO.

AKRON, OHIO

Offices in all principal cities

Manufacturers of Mechanical Rubber Goods, Tires, etc.

## BELTING

**TRANSMISSION BELTS**—Main drivers require the best quality. Weight and weave of duck, amount of stretch in service, and character of cover should be considered. We recommend the following grades:

**"Commander"**—friction-surface, gum cushion under first ply, extra quality for extreme service conditions.

**"Pinnacle"**—friction-surface, great strength, high quality.

**"Pilgrim"**—regular rubber covered, heavy duck, good friction and cover; for general service.

**"Marathon"**—a friction-surface belt of highest quality, built on special woven light, flexible duck—for small pulley, high-speed work.

Light drives, such as agricultural service, are well met by our **"Rob Roy,"** and **"Signal."**

**"B F G Drilling," "Sterling Stitched,"** and **"Oilfield Stitched"**—for all conditions of service in the oil fields.

**CONVEYOR BELTS** for conveying ore, coal, rock, etc., call for special qualities in the belt that have taken years of practical experience to develop. A duck of maximum strength and extreme flexibility, a strong friction, a wear-resisting cover, which will remain pliable and an edge armored against chafing are all required. We offer the following grades:

**"Goodrich Dredge"**—for the hardest conditions known to conveyor belt practice.

**"Longlife"**—for severe service, where extreme wear and economy are desired.

**"Maxecon"**—for ordinary service; medium priced, but reliable and serviceable.

**"Cossette" Belt**—one of exceptionally high quality throughout, for handling cossettes in beet sugar factories.

**"Whitecover" Canning Belt**—special white sanitary cover for food-canning factories.

**Grader Belt**—Recommend **"Maxecon"** with  $\frac{1}{2}$  or  $\frac{1}{4}$ " top cover.

For **GRAIN ELEVATOR BELTS** we offer the following:

**"Maxecon," "Meteor"** and **"Summit"**—horizontal carrier belts.

**"Pilgrim," "Mainstay,"** and **"Spec. 196"**—bucket-leg belts.

**ELEVATOR BELTS** for mines and quarries require a duck of extra strength, quality and weight to resist the tensile strains and the action of the bucket bolts. We use a special, heavy duck and recommend the following belts:

**"Goodrich" Elevator Belt**—special high grade for most severe service, especially recommended for wet mine elevators.

**"Akron"**—high grade, designed for hard duty.

**"Cost Cutter"**—designed for general conditions but has operated satisfactorily in hard service.

**"GOODRICH AXLE LIGHTING"** belt meets the severest service known—that of electric train lighting from the car axle.

**POLISHING BELTS**—Sometimes called Emery Belts; built on especially strong fabric with high quality, tough friction.

We are also prepared to furnish Magnetic Take-Off Belt, Separator Belts, etc.



# THE ROSSENDALE-REDDAWAY BELTING & HOSE CO.

NEWARK, N. J., U. S. A.

Manufacturers of "Camel Hair," Stitched Canvas, "Black Bird" Solid Woven,  
and Bird's Bull's-Eye Belting

---

## "CAMEL HAIR" BELTING



Reg. Trade Mark

For Power Transmission.

This belt is remarkable for its great strength (almost twice that of the leather belting), long life, small slippage, minimum stretching, straight true running, and for the fact that it is less affected by dampness or acid fumes than any other kind of belting. This belting is also sold under a guarantee that it will give longer, better service than any other style of belting running under the same conditions.

201

## BIRD'S BULL'S-EYE BELTING



Reg. Trade Mark

For Power Transmission and for Conveying.

## SOLID WOVEN BELTING

"Black Bird"

Reg. Trade Mark

For Power Transmission and for Conveying.

## STITCHED CANVAS BELTING

"Sphinx" Brand and lighter weights for all purposes.

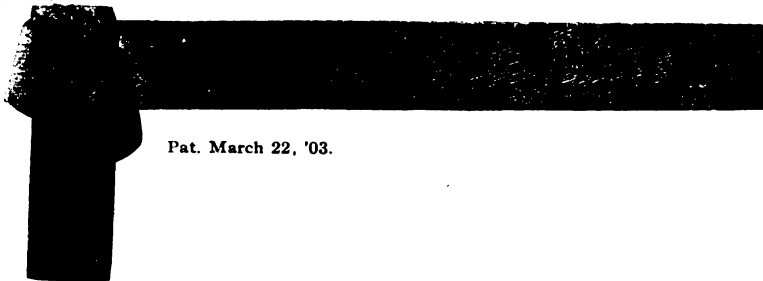
## BRAKE BAND LININGS

# **L. H. GILMER CO.**

**BELT DEPARTMENT**

**PHILADELPHIA, PA., U. S. A.**

**Manufacturers of Woven Endless Belts, Belting, Webbing, Tapes**



Pat. March 22, '03.

## **GILMER ENDLESS BELTS**

We are manufacturing Woven Endless Belts and Belting for light and heavy power transmission, conveying, polishing and sanding, also manufacturing all grades of narrow Web and Tape.

Our Endless Belts are used on Ball Race Grinders, Internal and Cylinder Grinders, Lathes, Drill Presses, Planers, Shapers, Joiners, Motors and Lighting Generators, for Threshing Machines, Saw-mills, Routers and Carvers, Fan Drives, Quill Winders, and many other drives similar to above, for power transmission. Also used for Folding, Wrapping and Labeling machines. For conveying Candies, Pharmaceutical goods, Groceries, Hardware and Metal parts and bricks; on Weighing Machines, Dish-washers, Paper and Box machinery; for Sanding and Polishing all kinds of Wood and Metal works.

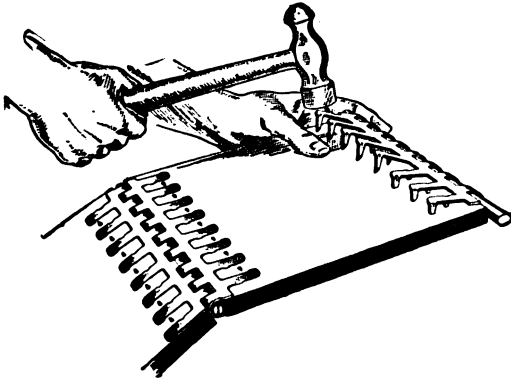
Our experimental department is equipped to develop special belts of materials for new lines. Our experience and service are always at the call of those desiring it. Our methods and equipment are such that no order is too small to receive prompt and thorough attention.



## FLEXIBLE STEEL LACING CO.

522 So. CLINTON ST., CHICAGO, ILL.

Manufacturers of Steel Belt Lacing and Lamp Guards



"Just a Hammer to Apply It"

### "ALLIGATOR" STEEL BELT LACING

Saves Time  
Saves Labor

The connecting bar between prongs is indented on the under side to allow it to be broken into required lengths and the use of a single section on any width of belt up to 12 inch. Each indentation separates a full staple which retains its efficiency.

Equip with ALLIGATOR—Now. The hinge joint is smooth on both sides alike, flexible and of extreme strength.

Gives lasting service on leather, cotton, rubber, balata or any width or thickness of machinery belting.

No delay to machine or operative, the joint made on the spot in a few minutes time.

### "FLEXCO-LOK" GUARD

For Incandescent Lamps

Prevents—Lamp breakage and reduces fire hazard.

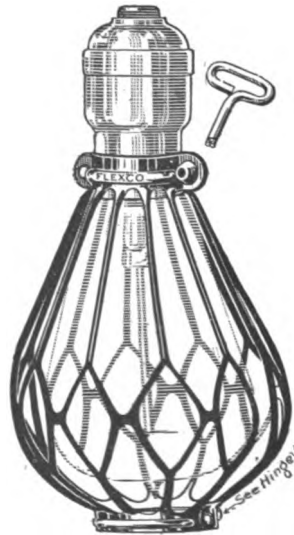
Protects—From theft.

Tested mechanical principles applied in a new manner.

Made from steel well coated with tin and is light and strong. The hinge shells close with special design key screws to a rigid grasp on the socket.

Guard lasts long, costs less than one lamp, will save you buying many lamps.

Both "Alligator" Steel Belt Lacing and "Flexco-lok" Guard reduce maintenance costs.



Catalog will be gladly sent by return mail.

## BROWN PORTABLE CONVEYING MACHINERY CO.

MAIN OFFICE AND WORKS: CHICAGO, ILL.

WESTERN OFFICE AND WORKS: PORTLAND, ORE.

NEW YORK

PHILADELPHIA

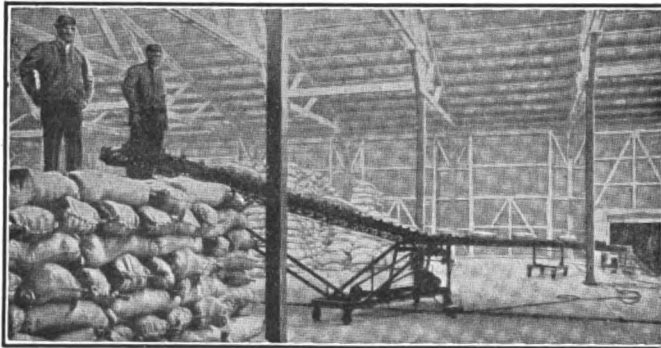
CLEVELAND

INDIANAPOLIS

SAN FRANCISCO

Sales Representatives in All Important Foreign Countries

**PORTABLE and SECTIONAL ELEVATORS  
PILERS—CONVEYORS—LOADERS—UNLOADERS  
for the Low-Cost Handling of Packed Materials**



A "Brown-Portable" installation which takes packages from hold of boat, carries them across warehouse to top of pile, eliminating all slow costly trucking. No hand labor except at receiving and delivery ends. Cuts costs 50%, reduces time radically, piles higher getting more storage room. Consists of Conveyor in two sections with Unloading section in boat and Piling section at pile.

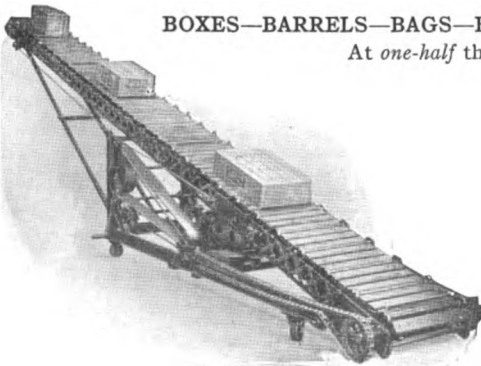
Every "Brown-Portable" machine is made to order—"Built to fit the job"—and guaranteed. They Load and Unload cars, wagons or boats—Pile to any height in warehouse or in the open—Elevate goods to upper floors—Convey packed goods—in industrial plants, mills, warehouses, on docks, etc.

Brown-Portable equipments are in use in practically every state and in 26 foreign countries, by industrial concerns, railways, steamship lines, and by Governments—wherever efficiency with low cost is appreciated.

**With a "Brown-Portable" you can Convey and Pile**

**BOXES—BARRELS—BAGS—BUNDLES—BALES—BULK**

*At one-half the cost of any other method.*



**Highest Award  
San Francisco  
Exposition**

*Ask for Descriptive Bulletin No. 40-2*

## H. W. CALDWELL & SON COMPANY

17TH ST. AND WESTERN AVE., CHICAGO, ILL.

EASTERN OFFICE: 50 Church St., NEW YORK CITY  
709 Main St., DALLAS, TEXAS

**Manufacturers of Elevating, Conveying and Power Transmitting Machinery;  
Machinery for Handling Material in Bulk or Packages**



### HELICOID "CONVEYORS"

Sole manufacturers of HELICOID SCREW CONVEYOR made of one continuous strip of metal without

laps or rivets. Mounted on standard and extra heavy pipe or solid shafts.

### PAN, APRON AND BELT CONVEYORS

Each designed and built to handle the material for which it is best suited, to the best advantage. For COAL, COKE, SAND, CRUSHED STONE, GRAVEL, GRAIN, BOXES, BARRELS, etc.



### CHAINS

Standard Malleable Iron Detachable Chain. Malleable and Steel bushed chains with or without rollers. Special chains for Conveying, Elevating or Power Transmitting Purposes.



### BUCKETS

We carry a large stock of standard size and weight Salem, Seamless Steel and Malleable Buckets. We are equipped to make special Buckets of all kinds to order.



### CHILLED RIM SPROCKETS

The life of the Chilled Rim sprocket is from Three to Five times that of the ordinary grey iron sprocket. Traction wheels and special sprockets furnished.



### GEARS

We can furnish gears with cast Teeth Machine Molded or Machine Cut. We have the most complete equipment in the country for machine molding gears. Spurs, Bevels, Mitters, Worms, Worm Wheels and Mortise Wheels.

We are prepared to furnish sheet steel conveyor troughs, hoppers, elevator casings, spouting, etc.

For a complete list of our line see a copy of our No. 38 catalogue. 800 pages of useful information to every engineer, designer, plant owner or superintendent.

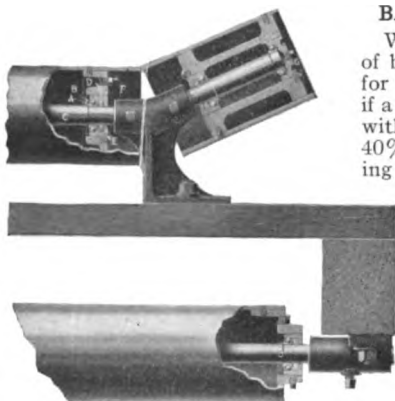


## THE CONVEYING WEIGHER CO.

90 WEST STREET, NEW YORK, N. Y.

AGENCIES: HERBERT AINSWORTH, Esq., The Corner House, JOHANNESBURG, S. AFRICA  
THE A. M. ELLICOTT Co., 301 St. James Street, MONTREAL, CANADA  
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MR. LUCIEN HERMANN, London Wall Bldg., LONDON, ENG.  
VICTOR M. BRASCHI MACHINERY COMPANY, MEXICO CITY, MEX.  
ZIMMER CONVEYOR COMPANY, 82 Mark Lane, LONDON, E. C., ENG.  
J. E. ROBERTSON, Mills Bldg., EL PASO, TEX.

**Ball Bearing Belt Conveyors; Continuous, Automatic Scales for Belt and Other Conveyors; Conveying and Hoisting Machinery; Complete Material Handling Plants; Trump Measuring and Mixing Machines; Trump Concrete Mixers**



**"Conweigh" Ball Bearing, Troughing and Return Idlers for Belt Conveyors (Patents Pending)**

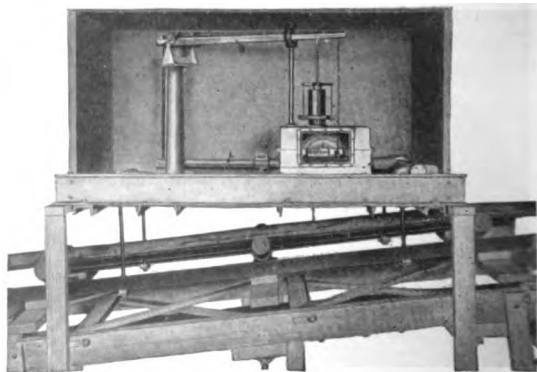
### BALL BEARING BELT CONVEYORS

We illustrate herewith the construction of ball bearing troughing and return idlers for belt conveyors. It is guaranteed that if a belt conveyor running level be equipped with these idlers, there will be a saving of 40% in power required. These idlers having felt oil-retaining washers need to be lubricated only once in two years.

- A Hardened steel "Cone" fitted on turned steel shaft
- B Pressed steel "Ball Retainer"
- C Turned steel shaft, set screwed in Idler brackets
- D Oiled washer of felt or carded wool
- E Hardened steel "Plug" screwed into pulley hub
- F Brass plug for lubrication
- G Lock screw to prevent hardened plug from turning

### THE MERRICK CONVEYING WEIGHER

This device records the weight of material handled on belt conveyors, bucket conveyor, cable railways and overhead trolleys or telfers. The weigher consists of a pair of weighing levers and a steelyard of special design so that a short section of the conveyor can be suspended from the weighing levers. The extreme end of the steelyard is connected with a totalizing mechanical integrator which derives its other factor from the travel of the conveyor by means of suitable gearing from a bend pulley on the return belt, or a sprocket wheel if on a bucket conveyor. This integrator continuously totalizes the product of two quantities, one proportional to the weight of material suspended and the other to the travel of this material. The result therefore represents the total weight of material and is plainly indicated by a register.



**View of Conveyor Weigher. Front Sheet of Casing Removed**



## LINK-BELT COMPANY

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CHICAGO

INDIANAPOLIS

**Manufacturers of Elevating and Conveying Machinery for Every Purpose.  
Power House Equipment. Power Transmission Machinery**

Original Ewart Link-Belt, >FLINT-RIM< Sprocket Wheels, Link-Belt Silent Chain Drives, Power Transmission Machinery, Pillow Blocks, Friction Clutches.

Power House Equipment: Peck Overlapping Pivoted Bucket Carriers, Belt Conveyors, Coal Bunkers, Crushers, Chutes, Telescoping Ashes Elevators, Coal Storage Systems, Traveling Water Intake Screens.

Bridge Tramways, Locomotive and Gantry Cranes, Telfers, Electric Hoists, etc.

Coal Tipples, Coal Washeries, Centrifugal Coal Driers, Car Hauls, Crushers,

Screens, Picking Tables, Chutes, Wholesale and Retail Coal Yard Equipment, etc.

Locomotive Coaling Stations, Cinder Stations, Complete Freight Handling Equipments.

Package Handling Machinery, Store Service Conveyors.

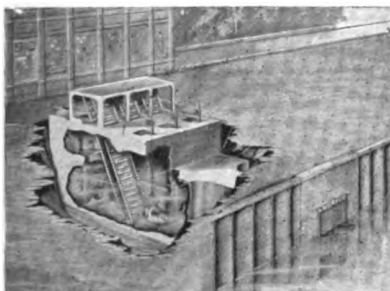
Portable Wagon and Truck Loaders, Portable Bag and Box Piling Machines.



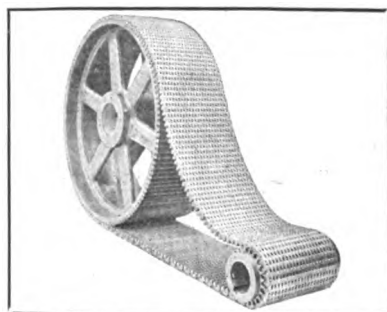
**Peck Overlapping Pivoted Bucket Carrier, for  
Coal and Ashes**



**Belt Conveyor**



**Link-Belt Traveling Water Intake Screens**



**Link-Belt Silent Chain**



**Link-Belt Locomotive Crane Storing Coal**



**Link-Belt Conveyor for Automobile Assembling**

## C. W. HUNT COMPANY, INC.

WEST NEW BRIGHTON, STATEN ISLAND, NEW YORK

New York City Office: 61 Broadway

Manufacturers of Coal and Ash Handling Machinery, Pivoted Bucket Conveyors, Hoisting and Conveying Machinery, Cable and Automatic Railways, Skip Hoists, Industrial Railway Equipments, Electric Locomotives, Motor Cars, Storage Battery Industrial Trucks, Transmission and Hoisting Rope, Special Scales and Weighing Hoppers, Coal Crackers



Single Door Charging Car



Storage Battery Industrial Truck

### INDUSTRIAL RAILWAYS AND CARS

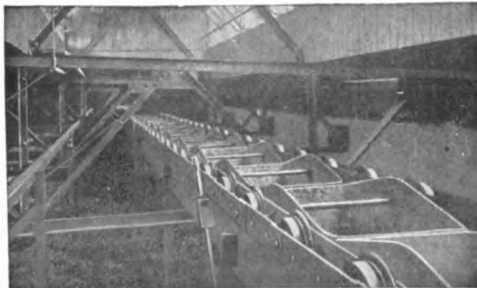
The boiler room cars for bringing coal to boilers are so designed that the labor of firing is reduced to a minimum, and the boiler room is kept clean. We design all types of cars for use in foundries, machine shops and all kinds of manufacturing plants. The use of outside flanged wheels permits one man to push a one-ton load on a sharp curve.

Ask for catalog U 16-2 on "Industrial Railways."

### STORAGE BATTERY INDUSTRIAL TRUCK

The Storage Battery Industrial Truck is designed to take the place of hand trucks, has a capacity from 2000 to 4000 lbs.; is simple and reliable.

Catalog U 16-1 on request.



Hunt Conveyor over Coal Bunker

### PIVOTED BUCKET CONVEYORS

consist of a series of independent swinging buckets free to dump in either direction. Conveyors can run in any direction, the buckets hanging in an upright position, therefore dry or liquid material can be handled. The peculiar system of driving by a pawl relieves the conveyor wheels of all stress.

Ask for catalog U 15-4 on "Conveyors."



## C. W. HUNT COMPANY, INC.

### MEASURING CHUTES

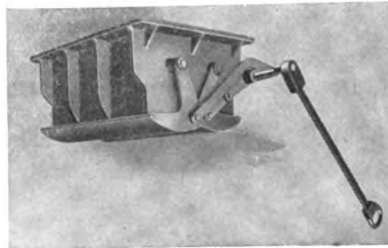
offer a method of accurately recording the volume of materials delivered. These chutes are used on locomotive coaling stations and their use results in accurate record of coal delivered to locomotive. Measuring chutes are operated by air or manually. *Catalog U 15-3.*



Air Operated Measuring Chute

### HUNT GATES

for coal and ashes pockets, also for any service where the flow of materials is to be controlled. These gates are designed for easy operation—they are manufactured in various types and sizes. *Catalog U 15-3* gives full data on this subject.



24" × 36" Duplex Gate

### INCLINED BOOM HOISTING ELEVATORS

are for rapid and economical hoisting of materials from vessels. The bucket, whether large or small, is carried from the hold of the vessel to the dumping place every trip in exactly the same course, and at any rapidity demanded. The bucket is carried exactly where wanted, rising vertically from the hold to the boom, running up the boom, and dumping at a fixed place.

These elevators are proportioned to suit the work and for use either with tubs or grab buckets. The lighter size is especially adapted for coal or ore hoisting, using any size bucket up to one-ton capacity.

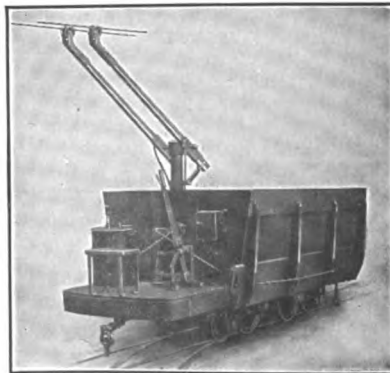


Inclined Boom Hoisting Elevators

### HUNT MOTOR CARS

#### Self-Dumping

made in many types, capacities up to 10 tons, and are equipped with motors and overhead trolleys or shoes for third rail as desired. Suitable for transporting coal, fertilizer materials, ores, and other bulk materials.



Hunt Motor Cars  
Self-Dumping

*General catalog U-102 on request.*

## THE LAMSON COMPANY

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REPRESENTATIVES IN ALL  
PRINCIPAL CITIES

WORKS  
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**Builders of Pneumatic, Selective and Mechanical Carrier and Conveyor Apparatus**

**Products.**—Pneumatic Tube Systems, Foot-Power Tubes, Selective Pick-Up and Sweep-Off Carriers, Automatic Tray Conveyors, Belt Conveyors, Gravity Roller Conveyors, Light Elevators and Lifts, Electric Cable and Wire Line Cash and Parcel Carriers.

**Scope of Use.**—Used in stores, offices, factories, libraries, banks, hotels, post offices, warehouses, freight yards, etc., for the conveyance of money, papers, merchandise, mail, and materials between departments or buildings. Over three hundred different lines of business are using Lamson equipment with profit and satisfaction.

**Co-operative Service.**—Architects, engineers and contractors are invited to avail themselves of Lamson experience and service. Engineers employed by this company are constantly solving complicated conveying problems and are in a position to apply Lamson Service to its best advantage. Full information and plans, covering any problem to which Lamson Carriers and Conveyors may be adapted, gladly furnished without charge.

**Lamson Systems.**—Lamson Systems cover the following types, and with their modifications can be made to suit any problem:

**PNEUMATIC TUBE SYSTEMS.**—Consist of tubes, terminals and carriers operated by vacuum or pressure supplied through special power equipment. System, rapid intercommunication and delivery of papers, cash, etc., to a central point by special carriers, which are placed in the tubes and automatically carried to points of delivery. This System is designed in the following types:

**Independent Lines.**—Consist of two tubes connecting two stations. Carriers may be sent in either direction. No lids to open or levers to manipulate at central desk. Carriers are taken from operator's hand by suction at bell mouth.

**Combination (Shifting Current) Line.**—Two or more out-stations may be intermittently operated by vacuum of a single ingoing line. Speed of carriers is the same as Independent Lines. All carriers are sent to central desk regardless of others in transit.

**Vacuo-Pressure Start and Stop Tubes.**—Built in units. Each unit a circuit reaching from two to eight out-stations. Motor remains idle until carrier is put in tube at any sending point, when it automatically starts, and stops only after carrier arrives at destination.

**LAMSON PATENT PICK-UP AND DELIVERY CARRIERS.**—Traveling metal fingers or clips, which move on an endless track, are arranged to pick up and deliver envelopes or single sheets automatically to indicated stations. (Fig. 2.)

**LAMSON AUTOMATIC TRAY CONVEYORS.**—Consist of a line operated by endless cable traveling about 75 feet per minute. (Fig. 3.)

**BELT CONVEYOR.**—Designed in conjunction with gravity chutes and elevators. Will handle boxes and packing cases, mail, etc. (Fig. 4, also Fig. 7.) *For heavy loads, Lamson Gravity Roller Conveyors are recommended.*

**LAMSON GRAVITY CONVEYOR.**—Consists of a series of rollers mounted on Ball Bearings carried in Angle Iron Frames. The Conveyor is inclined so that boxes, barrels, or other packages, placed upon it, will be carried by gravity from place to place. Gravity Conveyors use no power, are always ready to carry a package and require no care or attention. (Fig. 6.)

**LIGHT ELEVATORS AND LIFTS.**—Hand, pneumatic and electrically operated. Made for simple, light delivery or varied heavy service. (Fig. 9.)



Fig. 1. Lamson Patent Combination Shifting Current Vacuum Tube Construction

# THE LAMSON COMPANY



**Fig. 2. Lamson Pneumatic Tubes and Pick-up System Installed in a Bank**

Pneumatic Tubes provide quick communication, save time in sending correspondence, orders, blue-prints, etc., from place to place. Each system designed to fit individual needs.



**Fig. 3. Lamson Automatic Tray Conveyors**

Constantly moving metal fingers quickly pick up tools, stock, parts, documents, books and small loads of all kinds from one tray or station and deliver where desired. Made in sizes to fit special requirements. Automatic in action.



**Fig. 4. Lamson Belt Conveyors in Hat Factory**

For moving merchandise of all sorts and loads of materials in raw, unfinished and finished stages, from place to place. Lamson Belt Conveyor systems designed to fit special conditions in each business



**Fig. 5. Lamson Foot-Power Tubes**

For lines about 200 feet in length. One pressure of the foot sends carrier 75 feet horizontally or raises it 40 to 50 feet vertically. Made in 2 1/4" and 3" tubing.



**Fig. 6. Lamson Gravity Conveyors in a Shoe Warehouse**  
Lamson Gravity Roller Conveyors save time in handling boxes, barrels and other packages. These Conveyors may be run around corners, between floors, in fact, wherever desired.



**Fig. 7. Lamson Parcel Belt Conveyor in Department Store**

Lamson Conveyors save time in collection and delivery of packages. Enable parcels from various floors to be placed in delivery trucks and wagons in shortest time with least expense. Designed to meet needs of each individual store.



**Fig. 8. Lamson Pneumatic Tubes Installed in a Factory**

In many prominent factories a central planning department is connected by Lamson Pneumatic Tubes with all manufacturing departments. Orders are transmitted without loss of time and the manufacturing operations are greatly facilitated.



**Fig. 9. Lamson Double Elevator**

Types range from light hand-operated to pneumatic and electric. Made to meet any type of service required.

## **WELLER MANUFACTURING CO.**

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Designers and Manufacturers of Standard and Special

**ELEVATING, CONVEYING AND POWER**

**TRANSMITTING MACHINERY**

for

Cement Mills, Stone and Ore Crushing Plants,

Coal Handling Systems, Sand and Gravel Washeries,

Fertilizer and Phosphate Mills,

Grain Elevators and Flour Mills,

Cotton Oil and Cotton Mills,

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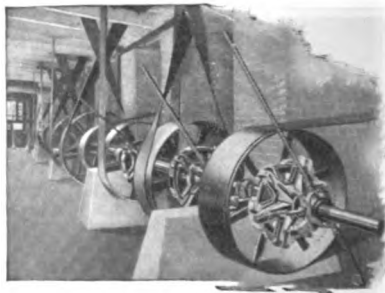
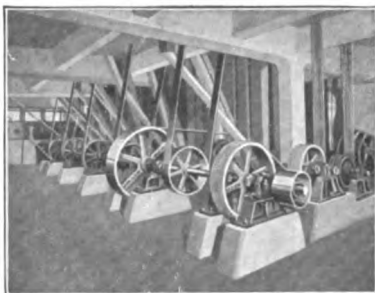
Tanneries, Brick Yards, Glass Plants,

Canneries, Paper Mills, etc.



Every member of The American Society of Mechanical Engineers should have our **General Catalogue N-40** on Elevating, Conveying and Power Transmitting Machinery.

The most complete volume ever published on this subject.

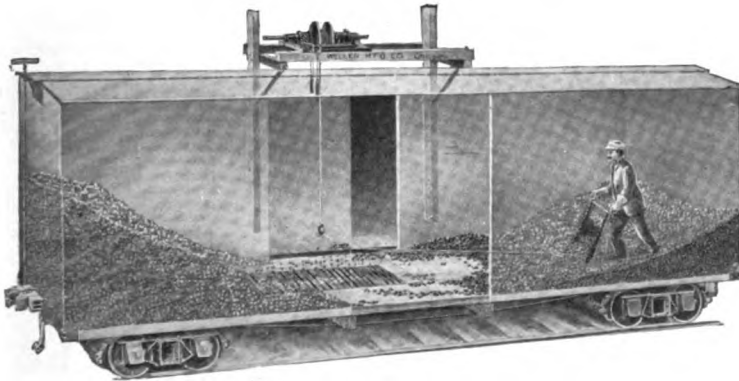


### **HEAVY LINE SHAFT EQUIPMENTS**

**Mounted on Iron Floor Stands**

**Every Pulley Fitted with Friction Clutch**

## WELLER MANUFACTURING CO.

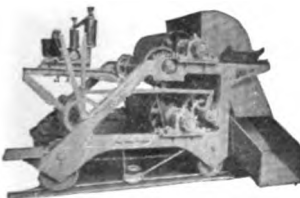


**AUTOMATIC POWER SHOVELS**

For unloading coal, ore, clay, sand, salt, cement, grain and other loose material



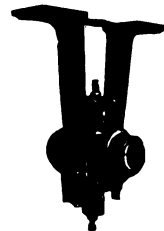
**HEAVY BUCKET ELEVATORS**  
Up to 84" width and 36" pitch



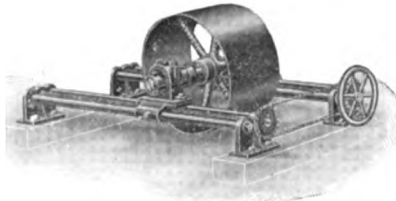
**HEAVY DUTY BELT TRIPPERS**



**PILLOW BLOCKS**  
Adjustable Ball and  
Socket Drop Hangers  
and Pillow Blocks



**HANGERS**



**BELT TIGHTENERS**

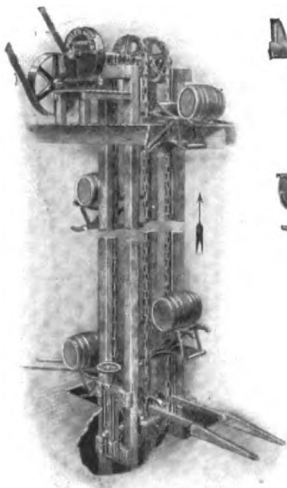


**BELT CONVEYORS, 10" to 60" wide**

(Continued on next page)

(Continued from preceding pages)

## WELLER MANUFACTURING CO. CHICAGO



### BARREL OR SACK ELEVATOR

Elevates and lowers goods at same time automatically delivering on either up or down run



COLD-ROLLED SCREW CONVEYOR

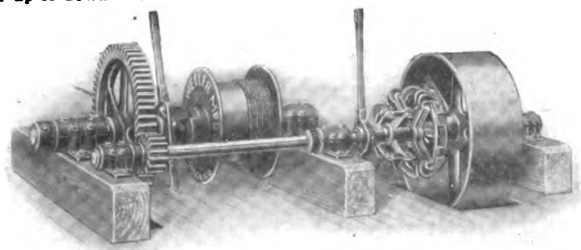


STEEL CONVEYOR BOXES



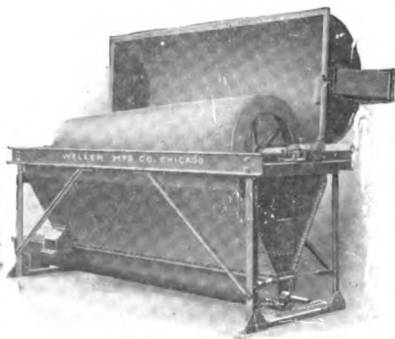
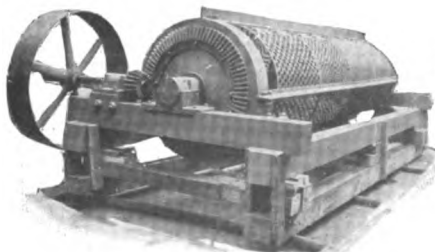
### ELEVATOR CASINGS

Of any design to suit any requirements



### CAR PULLERS

For handling from 1 to 50 loaded cars



REVOLVING SCREENS, OPEN OR ENCLOSED



# THE ALLIANCE MACHINE COMPANY

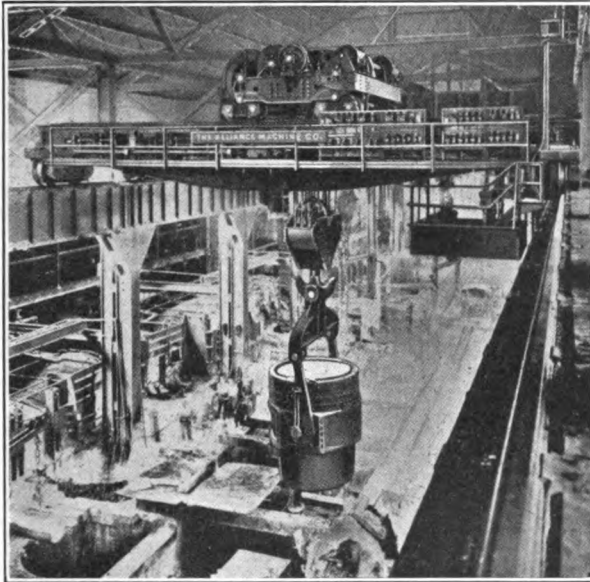
ALLIANCE, OHIO

PITTSBURGH

BIRMINGHAM

**Engineers and Builders of Electric Traveling Cranes and Machines of All Types for All Purposes; Ore Bridges; Rolling Mill and Hydraulic Machinery; Riveters, Steam Hammers, Heavy Punches and Shears; Coke Plant Machinery, Scale Cars and Charging Larries; Copper Converting Machinery**

## "ALLIANCE" ELECTRIC TRAVELING CRANES



215

The above illustration shows a 200-ton Single Trolley Crane designed and furnished by us for the Carnegie Steel Company. They have recently placed an order with us for an exact duplicate of this crane, after three years of service, without requiring a single change to be made.

We are now building for the Bethlehem Steel Company two similar type cranes, one of 225-ton and one of 250-ton capacity, which is the world's record for this type crane.

### **We Have Built:**

- The largest single trolley crane, 200 tons' capacity.
- The largest ladle crane, 175 tons' capacity.
- The largest stripper crane, 320 tons' capacity.
- The largest high type soaking pit crane, 25 tons' capacity.
- The largest slab charging machine.



# THE BROWN HOISTING MACHINERY COMPANY

CLEVELAND, OHIO

NEW YORK: 50 Church St.  
CHICAGO: 208 S. LaSalle St.

PITTSBURGH: Oliver Bldg.  
SAN FRANCISCO: Monadnock Bldg.  
Colby Engineering Co.: PORTLAND, ORE.

Engineers and Manufacturers of Locomotive Cranes, Heavy Dock Machinery, Bridge Cranes, Etc., as well as smaller Cranes and Hoists

**COAL AND ORE HANDLING MACHINERY**—Bridge tramways, fast plants, cantilever cranes, gantry cranes, furnace hoists, larries, transfer cars, bins, car tipples, and pig iron breakers. These machines are designed for the rapid handling of material and a long service. They are installed in many parts of the world.

**LOCOMOTIVE CRANES**—Eight- and four-wheel and for any gauge track; speediest locomotive crane built; equipped with M. C. B. couplers, standard trucks and fittings, steam brake, all steel gears; can be fitted with either a bottom-block, any kind of bucket, shovel attachment, magnet or piledriver, all interchangeable in a short time; easily operated; fitted with steam or electric power or with an internal combustion engine.

**BUCKETS**—Grab buckets, two and single rope; drag line buckets; contractors' clam shell buckets; slag buckets; and tubs. The designs of these buckets are such that they get a full load each time and are under the control of the operator at all times. The best of material is used throughout, giving strength and durability to the spades, bearings, and digging edges.

**TRAMRAIL SYSTEMS**—These systems handle all the material overhead, reaching every floor in each building and as much yard space as desired. We install the systems complete, using the well-known Brownhoist trolleys, which are recognized as the standard trolleys. Operated by electric or other power.

**OVERHEAD HAND TRAVELLING CRANES**—Furnished in various capacities and spans. Built for easy operation, safety and low headroom. They are easily and quickly erected. Prompt shipment can be made. Operated with hand hoist, air hoist, or electric hoist.

**FREIGHT HANDLING EQUIPMENT**—This includes several different machines designed for handling the freight at a much reduced cost over the present methods. The freight is handled overhead from car to sorting platform, warehouse, wagon or other cars. It requires just a few men, eliminates confusion and costly mistakes, and increases the terminal capacity.

**FERROINCLAVE**—A patented corrugated sheet steel used as a reinforcement for concrete. It requires no forms during erection, and is easily laid by the workmen. It is used for concrete roofs, floors, bins, walls, partitions, silos, bridges, stairs, etc.

We also make power scraper shovels, work-car cranes, jib cranes, pillar cranes, bridge cranes, cableways, crabs, winches, transfer tables and water-closet shields.

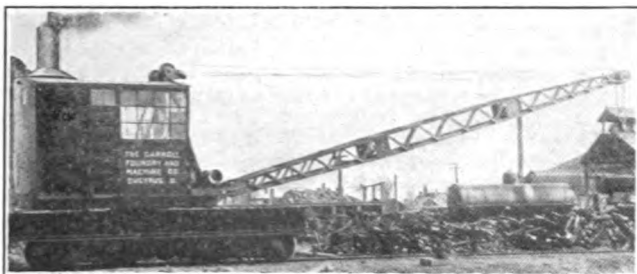
*Catalogs and prices furnished on request*



# THE CARROLL FDRY. & MACHINE CO.

BUCYRUS, OHIO

Manufacturers of Locomotive Cranes and Special Machinery



Eight - Wheel Crane equipped with a 46-foot boom, lifting flasks and other heavy materials about the foundry yard. It is also provided with a generating set and lifting magnet, for handling pig iron, scrap, etc.

## LOCOMOTIVE CRANES

We can furnish cranes of various types from 5 to 50 tons capacity operated by compressed air, steam or electricity. Our factory buildings and equipment for turning out such cranes are unsurpassed in contrast with the facilities of other manufacturers engaged in the same or kindred line of work. We operate grey iron and brass foundries, and have special facilities for getting quick delivery on our own requirements of steel castings.

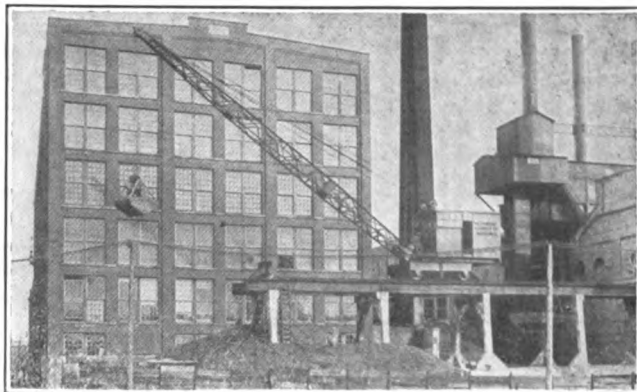
In our Engineering Department we have a number of experts who, as a result of long and successful experience in this field of work, are considered specialists. Their services are at the command of prospective purchasers, for solving problems and for offering advice on any matters relating to locomotive crane practice.

The illustrations show two classes of work to which a locomotive crane can be advantageously applied. There are many others and our line of cranes also covers many special designs to fit individual cases.

## SPECIAL MACHINERY

We have in the past built such apparatus as rolling mill hot and cold saws, gantry cranes, billet pushers, coke quenching pans, ore bin gates, charging cars, etc.; multiple tapping and threading machines, metal lath machinery, steam shovel parts, etc., and shall be pleased to figure on the drawings and specifications of prospective customers for this class of machinery or for any special machinery of any kind.

Four - Wheel Crane for 8-foot gauge of track, equipped with a 60-foot boom and mounted on a trestle 32 ft. high, electrically operating a  $1\frac{1}{2}$  cubic yard bucket for handling coal.



# INDUSTRIAL WORKS

BAY CITY, MICH.

BRANCH OFFICES: 50 Church St., NEW YORK, and Widener Bldg., PHILADELPHIA  
Agencies in Principal Cities

**Builders of Locomotive, Erection and Wrecking Cranes; Gasoline Coaling Cranes; Pillar Cranes; Transfer Cranes; Pile Drivers; Transfer Tables; Portable Rail Saws; Grab Buckets; Lifting Magnets; and Pile Driver Steam Hammers**

INDUSTRIAL WORKS was founded in 1873 and Industrial Works Cranes of today are the development of over forty-four years' experience. Satisfactory service under widely varied conditions of service has proved that they are fundamentally correct in design, sturdy in construction and efficient in operation. In size they range from 2-ton hand operated cranes to wrecking cranes of 160 tons capacity.

**Locomotive Cranes.**—Industrial Works Cranes, steam-, gasoline- or electrically operated, are made in capacities of from 5 to 60 tons, and with booms from 20 to 125 ft. long. They are mounted on four- or eight-wheel cars for standard or special gauge track, or on boats and gantries. Being self-propelling, they can switch several loaded cars. These cranes may be used with grab buckets, hook and block, lifting magnets, or arranged for operating with a drag-line bucket, pile-driver leads, or a steam-shovel dipper arm.

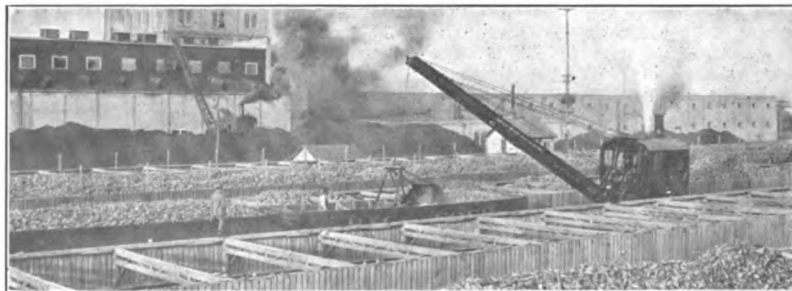
Mechanically, Industrial Works Cranes are not excelled. Every essential part of the entire crane is made, assembled and tested in our own extensive shops. All parts of the crane are accessible for easy examination, a large man being able to pass through the machinery part and car to the ground. Absolute interchangeability of parts is assured by the use of jigs and templates at every possible point in the construction. Inconvenient bearings are lubricated through oil pipes. The propelling gears on 8-wheel cars are placed in or out of mesh from the outside of the car body. For clam-shell bucket work, both drums are independent and the auxiliary take-up drum for the holding line is automatic in its action, requiring no attention from the operator.

**Data.**—In general all sizes of locomotive cranes do the same kind of work, the amounts being limited, of course, by their capacities. The 60-ton capacity cranes are used chiefly for erection purposes; those from 20 to 40 tons for erection work or for handling large quantities of material with a bucket or magnet; cranes from 5 to 20 tons are general purpose machines, and are in general use for all kinds of loading and placing of material.

Locomotive cranes are usually rated according to their maximum free capacity at the minimum radius (about 12 ft.). The table gives the approximate radius in feet at which various size cranes will handle clam-shell buckets full of coal and sand. (A 1½-cu. yd. bucket holds approximately one ton of coal.)

		1½-Yd. Bucket					2-Yd. Bucket		
Coal Sand	5-ton	10-ton	12-ton	15-ton	20-ton		25-ton	30-ton	40-ton
	20-25	30-33	34-37	41-46	48-52		49-52	52-54	58-61
	18-22	26-29	30-33	36-41	44-48		37-41	42-46	47-51

To unload material with a grab bucket from the far end of a modern gondola car standing on the same track as the crane requires a 50-ft. boom. In general, the shorter the boom, the easier and faster will be the operation of the crane.



## **CLYDE IRON WORKS**

**29th AVENUE WEST, AND MICHIGAN ST., DULUTH, MINN.**

**Manufacturers of Hoisting Engines, Derricks and Derrick Fittings, Electric Hoists, Belt-Driven Hoists, Automatic Buckets**

### **HOISTING ENGINES AND BOILERS OF CLYDE-GRADE**

Our product is used for all kinds of Contractor's work, Dredging, Pile Driving, Railroad and Bridge Building, Quarries and general hoisting purposes. We also make a specialty of engines for skidding and loading logs, and for general logging operations.

All our engines are thoroughly tested under steam as well as by the usual hydrostatic test. All parts are made from standard jigs and templates and are absolutely interchangeable.

### **ONE, TWO, THREE, AND FOUR DRUM HOISTING ENGINES**

In our 235-page catalog we illustrate the 2099 types and sizes of our standard engines with single or multiple drums, and single or double cylinders. These hoisting engines are regularly built with or without boiler, winch and sheave heads, and reversing gear. Clyde hoists of 7 x 10 and larger are built with all-steel gears.

### **DERRICKS AND DERRICK FITTINGS**

In this large catalog we also illustrate and list a complete line of timber derricks and fittings. All usual conditions can be met with some one of our standard styles, but we are prepared to build derricks for any special conditions that may arise. For this purpose we maintain a force of draftsmen and engineers who are specialists in this line, and their experience of many years is at the disposal of our customers.

Clyde Derricks are designed with great care to withstand violent strains. Every possible point of weakness, both in the fittings and in their action on the timbers, has been guarded against and we claim our fittings to be the strongest on the market for the size of timbers for which they are intended.

Following is a partial list of our standard styles of derricks:

Standard Guy Derricks  
Half Hand Power Guy Derricks  
Hand Power Guy Derricks  
Clam Shell Guy Derricks  
Standard Stiff Leg Derricks  
Half Hand Power Stiff Leg Derricks

Hand Power Stiff Leg Derricks  
Clam Shell Stiff Leg Derricks  
Full Circle Stiff Leg Derricks  
Self-Propelling Derrick Cars  
Self-Contained Portable Derricks  
Bulletin "N" contains our new  
line of All-Steel Derricks

We also manufacture a complete line of logging machinery, of land-clearing machinery and of excavating machinery, including the **FIELD TOWER EXCAVATOR** for levee building and drainage-canal digging.



## **LIDGERWOOD MANUFACTURING CO.**

**MAIN OFFICES**

**96 LIBERTY ST., NEW YORK**

**BRANCH OFFICES:**

**CHICAGO, Fisher Building**  
**SEATTLE, 65 Columbia Street**

**PITTSBURGH, Union Bank Building**  
**PHILADELPHIA, Widener Building**  
**LONDON, ENGLAND**      **LOS ANGELES, Hibernian Bldg.**

**Manufacturers of Steam Hoisting Engines, Electric Hoists, Gasoline Hoists, Cableways, Dredging and Excavating Machinery, Logging Machinery**

**FOREWORD:** The Lidgerwood hoisting machinery of today embodies every improvement in design and construction developed by our 44 years' experience. We have devoted ourselves exclusively to the manufacture of hoisting and hauling machinery.

It is our practice to design the complete machine to operate under the maximum service it is to perform, and to build every part to meet the full working capacity of the machine.

Every part is accurately constructed upon the duplicate part system, insuring the absolute fitting of repair parts.

We have kept pace with the development of electrical engineering, and can supply our electric hoists equipped with the latest automatic control and safety devices, and type of motor best adapted for the work to be done by the hoist.

Our friction drum hoists have cork inserted friction woods. This increases the holding power of the friction and greatly reduces the power required to apply the friction. The entire friction mechanism is extremely simple.

**STEAM, ELECTRIC AND GASOLINE HOISTS** for all kinds of derrick service, including grab bucket work.

**STEEL DERRICKS** of all types; derrick fittings for wooden derricks.

**PILE DRIVING HOISTS**, pile driving frames and hammers.

**HIGH SPEED BUILDERS' HOISTS** for operating material and hod elevators.

**STEAM AND ELECTRIC HOISTS** designed for shaft and tunnel work, bridge erection and to meet every requirement of contracting work.

**DREDGING AND EXCAVATING MACHINERY.** Steam and electric bucket and swinging engines for operating both grab and scraper buckets on land and water outfits, both for dredging, and for loading and unloading sand, gravel and coal barges.

Spud engines and cutter engines for suction dredges.

Built with special regard to the severe duty such machines perform.

**STRAIGHT LINE CABLEWAY EXCAVATORS**, steam or electric driven, with traveling towers, built in spans to meet service required. Operate drag scraper, or grab buckets.

The high conveying speed enables them to excavate material rapidly and economically over wider areas than it is practicable to reach with the revolving type of excavator. Have handled 55 trips per hour, over a reach of 500 feet, using a three cubic yard scraper bucket.

**CABLEWAYS:** Lidgerwood cableways, steam or electrically driven to handle loads of from one to fifty tons, with spans up to 3,000 feet and with fixed or traveling towers. They are equipped to handle plain skips, automatic dumping skips, concrete tubs, clamshell, orange peel, or scraper excavator buckets. A prominent feature is the high speed fall rope carrier.

**MINE HOISTS** for every character of incline haulage and mine shaft service. Steam hoists built up to 1000 H. P. and electric in any size, and fitted with complete control and safety appliances.

**LOG HANDLING SYSTEMS:** High speed ground and overhead log skidding systems.

**RAPID UNLOADERS** for unloading ballast cars.

**CAR HAUL HOISTS.**

**INCLINE COAL HOISTS.**

**COAL TOWER BUCKET AND TROLLEY HOISTS.**

**SHIPS CARGO AND DOCK WINCHES.**

**STEERING ENGINES.**

*We will gladly send catalogues covering above products.*



# THE WELLMAN-SEEVER-MORGAN CO.

CLEVELAND, OHIO, U. S. A.

Engineers and Manufacturers

WORKS: CLEVELAND AND AKRON, OHIO

BRANCH OFFICES: NEW YORK AND DENVER



Twelve Foot Double Drum Direct Action Mine Hoist

## WATER POWER EQUIPMENT

Hydraulic Turbines, Vertical and Horizontal Settings for all heads up to 800 feet. Especially designed for High Efficiency.

Johnson Hydraulic Valves for Water Power Plants and Water Works



Wellman Open Hearth Charging Machine

## COKE OVEN MACHINERY



Combined Coke Pusher and Coal Leveler

## ORE AND COAL HANDLING MACHINERY



Boat Loading Coal Car Dumper

## MINING MACHINERY

Hoists, Haulages and Gravity Incline Machines, Steam and Electric Driven, from 3 H. P. to 2000 H. P. in any combination of equipment for any service.

Cages, Skips, Safety Detaching Hooks and Sheaves.

Chilian Mills, Car Tipples, Dumping Cradles and Head Frames.



15000 Horse Power Turbine

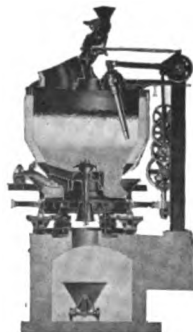
## IRON AND STEEL WORKS EQUIPMENT

Open Hearth, Heating and Annealing Furnaces and Metal Mixers.

"Wellman" Charging Machines and Manipulators. High and low floor and crane types. Open Hearth Charging Cars and Boxes.

"Hughes" Continuous Mechanically Poked Gas Producers and W-S-M Gas Shut-off Valves.

"Forster" Water-Sealed Reversing Gas Valves. Blooming Mills and Engines.



Hughes Gas Producer

Coal Levelers, Coke Pushers and Door Extractors, in separate or combined machines. Charging Cars, Quenchers and Loaders.

"Hulett" Automatic Vessel Unloaders, Steam, Electric and Hydraulic driven. Bridges for unloading and Stocking Ore, Coal and Limestone.

Buckets: two part Clam-Shell.

Car Dumpers: steam and electric driven. Revolving Derricks and Bucket Handling Cranes.

Catalogues or Bulletins, and prices furnished on request.

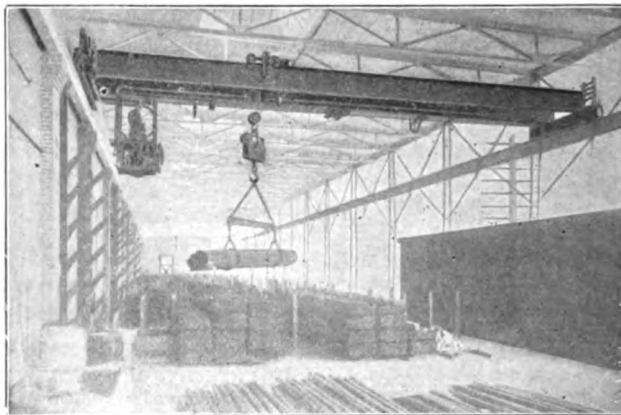


## **NEW JERSEY FOUNDRY & MCH. CO.**

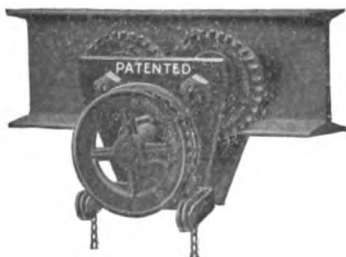
88 WEST ST., NEW YORK

**Manufacturers of Overhead Carrying Devices**

### **HAND AND ELECTRIC TRAVELING CRANES TROLLEYS, HOISTS AND MONORAIL EQUIPMENT**



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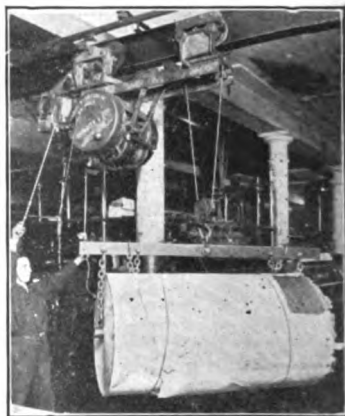
**"Changeezy" I-Beam Trolley (Patented)**

Can be used both plain and geared. Made with steel side plates and adjustable to three sizes of beam standard.



**"Delta" I-Beam Trolley (Patented)**

The wheels of both Changeezy and Delta trolleys are inclined to run true on lower flanges of the beam, the axle connection swivels, equalizing the load on all wheels and the load force lines radiate from the inside of the hoist link.



Our Catalog 88 contains detailed information on our line of Overhead Carrying Devices, Tracking, Trolleys, Hoists, Cranes, Buckets, Cars, etc. Two representative installations are shown above. Many others illustrated in catalog. A copy will be promptly sent on request.



# SHEPARD ELECTRIC CRANE & HOIST COMPANY

NEW YORK  
PHILADELPHIA  
BOSTON  
PITTSBURGH  
CHICAGO

MAIN OFFICE & WORKS

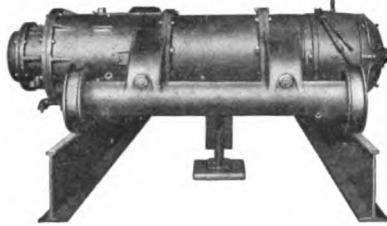
MONTOUR FALLS, N. Y.

SAN FRANCISCO  
MONTREAL  
BIRMINGHAM  
LONDON, ENGLAND

Direct and Alternating Cranes and Hoists for Every Service

**ELECTRIC CRANES:** The Shepard Line specializes on fully developed cranes in capacities of from  $\frac{1}{4}$  to 30 tons. It includes standard 3-Motor Cage Controlled Electric Traveling Cranes, Grab-bucket Cranes, Single I-Beam Cranes, Jib Cranes, Bracket Cranes, Transfer Cranes for use in combination with heavy duty Monorail Systems, and a variety of special types.

**The Shepard Standard Type Crane Trolley** provides oil bath lubrication, complete dirt exclusion, and permanent alignment for the gearing, brakes and motor. Gearing—Steel, Heat treated. Brakes—Multiple Disc, Standard Design.



Form 6—Standard Type Crane Trolley

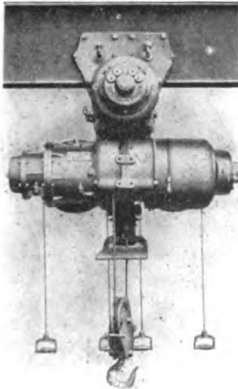
**ELECTRIC HOISTS:** To meet the various handling requirements of more than eighty-five industries, many types and capacities have been developed.

**Form 1 Hoist** is built in capacities of from 1 to 20 tons and is furnished with plain, geared or motor driven trolley. This is the most frequently used type of hoist for runway and simple I-beam crane service.

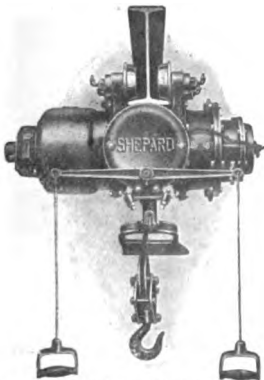
**Form 2XS Hoist** is a new hoist we have just developed for a field that heretofore has been covered by chain blocks. May be used for a wide variety of purposes where light loads prevail. Built in capacities of  $\frac{1}{4}$  ton,  $\frac{1}{2}$  ton and 1 ton, either with plain trolley or hook type, which is portable and can be utilized in many places.

**Form 13 Grab Bucket Hoist** employs two standard hoisting units independently controlled. Provides the most flexible and efficient means of unloading, storing and serving coal in connection with medium size power houses.

There is a Shepard Crane and Hoist specialized to meet your needs. Tell us your problem.



Form 1 Hoist with Motor Driven Trolley



Form 2XS Hoist with Plain Trolley

## THE SHEPARD TRACK

Its advantages are obvious in that A. S. C. F. rails having hard wearing surfaces is a distinct advantage over the soft steel I-beam. It also provides for greater effective bearing lengths in the trolley wheels. Note that punching or drilling the I-beam is unnecessary as spreader castings are placed at intervals along the runway, the bolts passing through them fastening the rails securely to the beam.

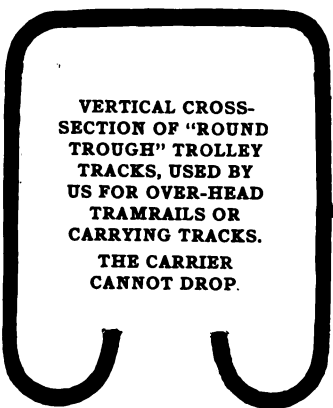


Shepard Double Rail Track

## THE COBURN TROLLEY TRACK MANUFACTURING CO.

HOLYOKE, MASS.

Manufacturers of Overhead Tramrails, Traveling Cranes, Electric and Pneumatic Hoists, Door Hangers, Fire Shutters, Fire Escapes, Etc.



**VERTICAL CROSS-SECTION OF "ROUND TROUGH" TROLLEY TRACKS, USED BY US FOR OVER-HEAD TRAMRAILS OR CARRYING TRACKS. THE CARRIER CANNOT DROP.**

### COBURN OVER-HEAD CONVEYING SYSTEM

The uses of Coburn Over-head Conveying systems are so various that it is quite impossible to enumerate them all.—They can be used anywhere that heavy material has to be handled—Coal to the boiler room—Ashes and cinders to the dump head—Iron in foundry and machine shops—etc.,—etc.

Besides the enclosed type of track, we manufacture a complete line of Over-head I-Beam track, carriers, switches, etc.

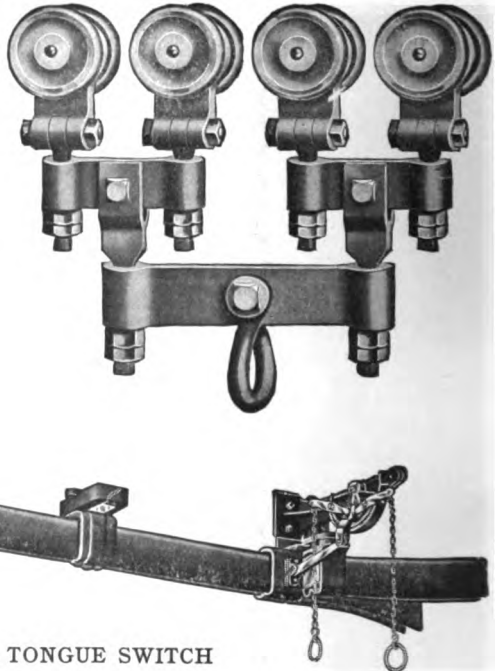
We furnish free of cost estimates on all this class of work on receipt of detailed information as to requirements.

*Our No. 50 catalogue is free for the asking.*

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### SWINGING PENDANT DOUBLE CARRIERS

A typical Coburn Carrier which can be equipped with either roller or ball bearings, and so constructed as to move around the smallest curves with the greatest ease.



REGULAR TONGUE SWITCH

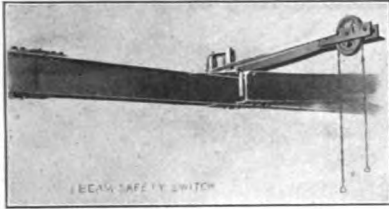
No matter how complicated your system may be, we can make satisfactory arrangements for the switches—Our switches are absolutely safe—They cannot under any conditions drop the load.

# PHILADELPHIA TRAMRAIL CO.

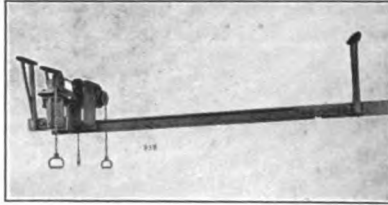
FRONT AND TUSCULUM STS., PHILADELPHIA, PA.

Manufacturers of Overhead Track Systems, Switches and Trolleys

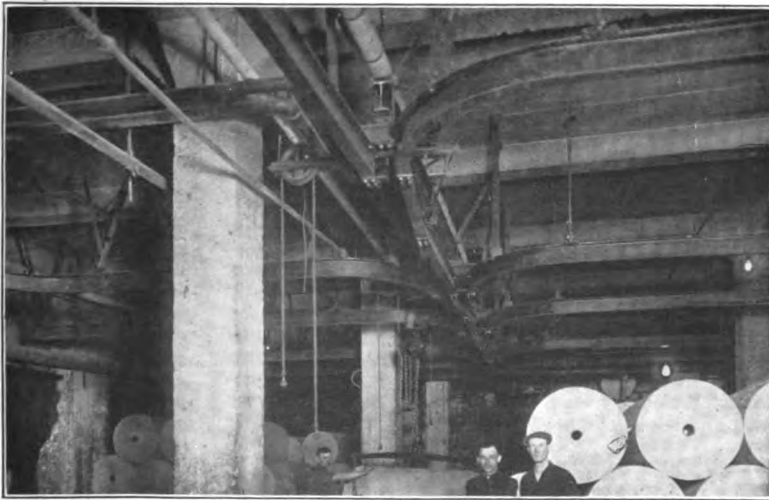
## OVERHEAD TROLLEY EQUIPMENT



**I-Beam Safety Switch**



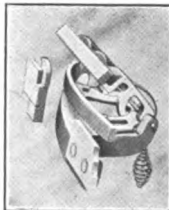
**Heavy Flat Rail Safety Switch**



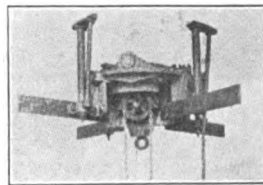
**Showing Tramrail System for Paper Storage Room**



**I-Beam Turntable**



**Ideal Switch with  
Safety Stop**



**Flat Rail Turntable**

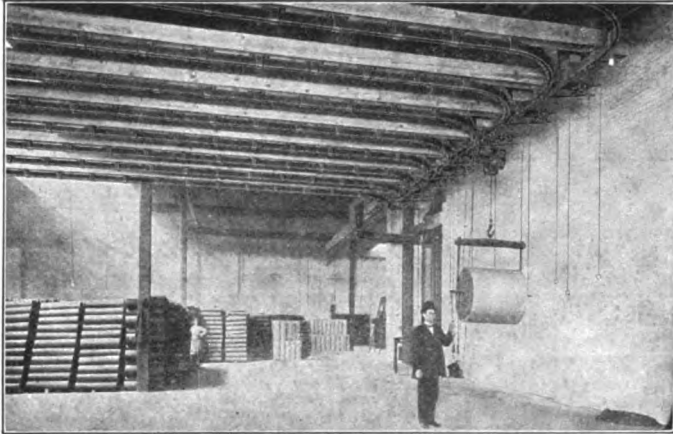
We are specialists on designing and installing overhead trolley systems for conveying all kinds of materials. Catalogue on application.

## RICHARDS-WILCOX MFG CO.

AURORA, ILL.

Manufacturers of Overhead Trolley Carrying Systems, Automatic Fire Door Fixtures; Sliding Door Hangers for Warehouses, Factories, Etc.

### RICHARDS-WILCOX OVERHEAD CARRYING SYSTEMS

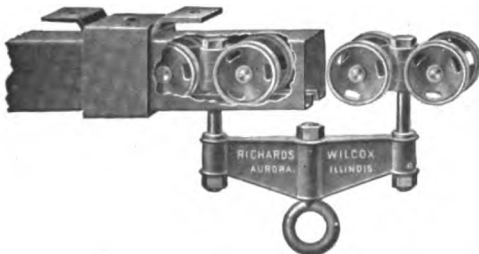


Typical Installation of Richards-Wilcox Overhead Trolley Track

The illustration above shows a typical arrangement of Richards-Wilcox Overhead Trolley Tracks in a large factory. The construction of this track is such that it is impossible for a carrier to drop out, and an ample factor of safety is provided against breakdowns.

Perfect flexibility is assured by a system of switches and turntables which provide for any desired arrangement of tracks.

These switches and turntables are absolutely "Fool-Proof" in that their construction leaves no possibility for carriers to drop no matter how turned or in what position.



Sixteen-Wheel Carrier, Capacity 2500 Lbs., Runs in No. 175 Track. Eight-Wheel Carrier, Capacity 1250 Lbs., Runs in No. 175 Track

### CARRIERS

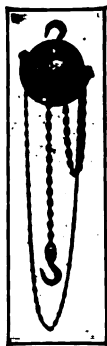
Carriers are built with hardened roller bearings, also with hardened ball bearings in five regular sizes having capacities up to 3000 lbs. and can be run around curves of 24' radius. A larger radius is advised, however, when it can be used. I-beam overhead carrying systems for carrying loads up to 8,000 lbs.

*Illustrated catalogs and full information concerning standard or special layouts and designs furnished on request.*

# FORD CHAIN BLOCK & MFG. CO.

139 WEST OXFORD STREET, PHILADELPHIA, PA.

Manufacturers of the Ford Tribloc Chain Hoist, Screw Gear Hoists, Differential Hoists and Plain and Geared Trolleys



## THE FORD TRIBLOC CHAIN HOIST

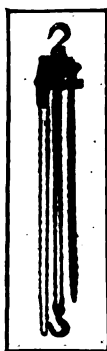
The Ford Tribloc Chain Hoist is built in sizes from one-half to forty tons capacity. It is equipped with the patented Loop Hand-Chain Guide which protects the working parts, keeps the chain from gagging, and enables you to operate at any angle and at any speed you may wish to. It has steel working parts, planetary gearing (which is enclosed in a dust-proof steel case), and a  $3\frac{1}{2}$ -to-1 factor of safety in its weakest part. Eighty per cent. of the power applied to the hand-chain of the Tribloc is converted into lifting energy.

### PRICE LIST—TRIBLOC CHAIN HOISTS

Capacity in Tons	Price Complete	Regular Hoist in Feet	Extra Hoist Price per Foot	Net Weight in Pounds	Feet of Chain Handled to Lift Load One Foot
$\frac{1}{2}$	\$35.00	8	\$0.90	54	21
1	45.00	8	.95	80	31
$1\frac{1}{2}$	60.00	8	1.00	124	35
2	70.00	9	1.05	188	42
3	90.00	10	1.50	200	69
4	110.00	10	1.60	290	84
5	140.00	12	2.15	380	126
6	165.00	12	2.15	390	126
8	200.00	12	2.70	470	168
10	240.00	12	3.25	570	210
12	300.00	12	4.30	800	126
16	360.00	12	5.40	1000	168
20	425.00	12	6.50	1375	210
32 } 40 }					

Prices and full particulars upon request.

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## SCREW HOISTS

(Duplex Type)

For work where the highest speed and efficiency are not required, we can furnish the Ford Duplex Type Worm Gear Hoist. This type of hoist is frequently preferred for portable use, as it is lighter in weight and at the same time powerful and durable.



## DIFFERENTIAL HOISTS

This is the simplest of all chain hoists, and where a hoist is required but occasionally and high efficiency and speed are not essential, it serves the purpose admirably. The Ford Differential Hoist is made with exceeding care and of the best material obtainable.

## ROLLER BEARING STEEL PLATE TROLLEYS

We carry in stock ready for immediate shipment, a line of Roller Bearing Steel Plate I-Beam Trolleys in a wide range of sizes, and in both the plain and geared types. Trolleys can be widened to suit larger than standard beams.

Send for a copy of our catalogue.  
It gives prices and goes into details.



# MACOMBER & WHYTE ROPE CO.

HOME OFFICE AND WORKS  
KENOSHA, WISCONSIN

BRANCHES AT

CHICAGO

PORTLAND

PITTSBURGH

Makers of Wire Rope of Every Description

## WIRE ROPE

"Monarch Whyte Strand" is made from wire having a tensile strength of from 220,000 to 280,000 pounds per square inch—it is superior to any other wire rope made—it is uniform and dependable—the strongest, toughest and most durable rope obtainable—this is the best—but we make all grades—and all constructions—some are listed below.



## STANDARD HOISTING ROPE

6 Strands of 19 Wires Each—1 Hemp Center

### LIST PRICE PER FOOT IN CENTS

Dia. of Rope	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3
Monarch Whyte Strand	13	14 1/2	17	22 1/2	31	39	50	62	75	90	1.10	1.30	1.60	1.75	1.85	2	2.15
Plough Steel	12	12 1/2	14	19	26	34	43	54	65	79	93	1.08	1.30	1.46	1.58	1.70	1.85
Crucible Steel	9	9 1/2	11	14	19	24	31	38	46	56	66	77	90	1.02	1.16	1.28	1.46

### BREAKING STRENGTH IN TONS OF 2000 LBS.

Dia. of Rope	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/4	4 1/2	4 3/4
Monarch Whyte Strand	3.5	6.7	12	19	26	35	45	56	69	84	98	110	133	150	166	182	200
Plough Steel	3	6	10	16	23	29	38	47	58	72	82	94	112	127	140	154	170
Crucible Steel	2	5	8	12	17	23	30	38	47	56	64	72	85	96	106	116	128
Weight Per Foot—Lbs.	.10	.22	.39	.62	.89	1.20	1.58	2.02	2.53	3.14	3.84	4.64	5.54	6.54	7.64	8.84	10.14

## HAULAGE ROPE

6 Strands of 7 Wires Each—1 Hemp Center

### LIST PRICE PER FOOT IN CENTS

Dia. of Rope	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3
Monarch Whyte Strand	14	16 1/2	20	26 1/2	34	43	54	66	79	94	1.10	1.30	1.60	1.75	1.85	2	2.15
Plough Steel	13	15 1/2	19	25 1/2	33	42	53	65	78	93	1.08	1.28	1.58	1.73	1.83	2	2.13
Crucible Steel	10	12 1/2	15	20 1/2	28	36	46	58	70	85	1.00	1.20	1.50	1.65	1.75	2	2.10

### BREAKING STRENGTH IN TONS OF 2000 LBS.

Dia. of Rope	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/4	4 1/2	4 3/4
Monarch Whyte Strand	4.5	9	15	22	30	39	49	60	72	84	98	112	133	150	166	182	200
Plough Steel	4	8	14	21	29	38	48	59	71	83	96	110	127	140	154	170	187
Crucible Steel	3	7	12	18	25	33	42	52	63	74	86	98	112	124	136	150	164
Weight Per Foot—Lbs.	.15	.22	.30	.40	.50	.62	.75	.89	1.08	1.20	1.36	1.54	1.72	1.90	2.08	2.26	2.44

## KILINDO-PATENT NON-ROTATING ROPE

We are the patent owners and makers of this non-spinning, non-twisting wire rope—particularly adaptable in all cases where the load hangs on the free end of a hoisting line—is more flexible than ordinary rope—has 200% greater wearing surface.



### LIST PRICE PER FOOT IN CENTS

Dia. of Rope	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3
Monarch Whyte Strand	14	16 1/2	20	26 1/2	34	43	54	66	79	94	1.10	1.30	1.60	1.75	1.85	2	2.15
Plough Steel	13	15 1/2	19	25 1/2	33	42	53	65	78	93	1.08	1.28	1.58	1.73	1.83	2	2.13
Crucible Steel	10	12 1/2	15	20 1/2	28	36	46	58	70	85	1.00	1.20	1.50	1.65	1.75	2	2.10

### BREAKING STRAIN IN TONS OF 2000 LBS.

Dia. of Rope	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/4	4 1/2	4 3/4
Monarch Whyte Strand	6 1/2	12	14 1/2	19	26	35	45	56	69	84	98	133	166	210	263	316	370
Plough Steel	5 1/2	10	12	15 1/2	23	29	38	47	58	72	82	112	140	186	229	282	335
Crucible Steel	4 1/2	8 1/2	10	12 1/2	17 1/2	23	30	38	47	56	64	85	106	133	170	207	244
Weight Per Foot—Lbs.	.25	.43	.55	.67	.95	1.3	1.7	2.2	2.7	3.3	3.9	5.5	7	8.8	11	13	15

Catalogue "M"—strictly up to date—sent upon request.

# JOHN A. ROEBLING'S SONS COMPANY

TRENTON, N. J.

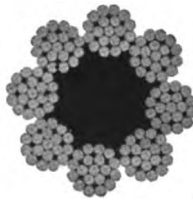
Manufacturers of Wire Rope of All Kinds



6 x 19



6 x 7



8 x 19



6 x 37

We manufacture and keep in stock at our works at Trenton and at warehouses at agencies and branches in large cities wire rope, made from Iron, Cast Steel, Extra Strong Cast Steel, Plough Steel and Blue Center Steel.

We give below tables of strengths, etc., for the standard constructions of BLUE CENTER STEEL ROPE. The rope is also furnished with 6 strands of 37 wires each and with 8 strands of 19 wires each.

This rope is recommended as the best to use where extreme conditions tend to bring extraordinarily severe stresses, and is particularly well adapted to resist abrasion.

The hemp center of this rope, where a hemp center is used, is colored blue to distinguish it from other grades.



## BLUE CENTER STEEL HOISTING ROPE

Composed of 6 Strands and a Hemp Center, 19 Wires to the Strand

Trade Number	Diameter in Inches	Approx. circumf. in inches	Approx. weight per foot	Approx. strength in tons of 2000 lbs.	Proper working load in tons of 2000 lbs.	Diam. of drum or sheave in feet advised
00	2 3/4	8 5/8	11.95	315	63	11
0	2 1/2	7 7/8	9.85	263	53	10
1	2 1/4	7 1/2	8	210	42	9
2	2	6 1/2	6.30	166	33	8
2 1/2	1 7/8	5 3/4	5.55	150	30	8
3	1 3/4	5 1/2	4.85	133	27	7
4	1 1/2	5	4.15	110	22	6 1/2
5	1 1/4	4 3/4	3.55	98	20	6
5 1/2	1 1/8	4 1/4	3	84	17	5 1/2
6	1 1/4	4	2.45	69	14	5
7	1 1/8	3 1/2	2	56	11	4 1/2
8	1	3	1.58	45	9	4
9	3/4	2 3/4	1.20	35	7	3 1/2
10	3/4	2 1/4	.89	26.3	5.3	3
10 1/4	3/8	2	.62	19	3.8	2 1/2
10 1/2	1 1/8	1 3/4	.50	14.5	2.9	2 1/4
10 3/4	1 1/4	1 1/2	.39	12.1	2.4	2
10a	1 1/4	1 1/2	.30	9.4	1.9	1 3/4
10b	1 1/4	1 1/2	.22	6.75	1.35	1 1/2
10c	1 1/4	1	.15	4.50	.9	1 1/4
10d	1 1/4	3/4	.10	3.15	.63	1

## BLUE CENTER STEEL ROPE

For Haulages and Transmissions. 6 Strands and a Hemp Center, 7 Wires to the Strand

11	1 1/2	4 1/4	3.55	90	18	11
12	1 1/4	4	3	79	16	10
13	1 1/4	4	2.45	67	13	9
14	1 1/4	3 1/2	2	52	10	8
15	1	3	1.58	42	8.4	7
16	3/4	2 3/4	1.20	33	6.6	6
17	3/4	2 1/4	.89	25	5	5
18	3/4	2 1/4	.75	20	4	4 3/4
19	3/4	2	.62	17 1/2	3.5	4 1/2
20	3/4	1 3/4	.50	13	2.6	4
21	3/4	1 1/2	.39	11	2.2	3 1/2
22	3/4	1 1/4	.30	7 3/4	1.5	3
23	3/4	1 1/4	.22	6 1/2	1.3	2 1/2

A copy of our catalogue, giving information about other wire ropes and wire rope fastenings will be mailed on application.

# WRIGHT WIRE COMPANY

WORCESTER, MASS.

BRANCH OFFICES: BOSTON, NEW YORK, PHILADELPHIA, CHICAGO, SAN FRANCISCO

Manufacturers of Wire, Wire Rope and Wire Products



WIRE ROPE

For All Purposes

We combine the highest quality of material with the greatest degree of skill in the manufacture of all our Wire Rope products.

Plow Steel Ropes

Crucible Cast Steel Ropes

Iron Ropes

Galvanized Ropes

Towing or Mooring Hawsers

Hoisting Ropes, Regular

Flexible, and Extra Flexible

Suspension Bridge Cables

Ropes for Tramways, and Cable for Transporting Coal, Ore, etc.

Ropes for Elevators, Power Transmission, Street Railways, Mining, Logging

Standing and Running Rigging  
Derricks and Dredges

Tiller Ropes

Copper Lightning Rod Cables

All Kinds of Wire Rope, Fittings and Appliances

Ordinary forms and sizes always in stock. Special forms made to order promptly.

We furnish ropes of Swedish Iron, Crucible Cast Steel, Extra Strong Crucible Cast Steel, Plow Steel, Excelsior Plow Steel, Bronze or other material.

## EXTRA FLEXIBLE ROPES, IRON, CRUCIBLE AND PLOW STEEL



8 Strands, 19 Wires  
to the Strand—  
1 Hemp Core



We desire to call special attention to our **Extra Flexible Ropes**, of which we manufacture large quantities, and which have become very popular with users of wire ropes in various industries.

Our **Extra Flexible Ropes** are made of eight strands around a hemp core, instead of the standard form of six strands. They are thoroughly efficient and very strong, and because of their much greater flexibility can be used under many conditions in which the use of six-strand ropes would not be feasible. They are designed for running over comparatively small sheaves.

Recommended for derricks, steam dredges, electric cranes, coal-hoists, for logging purposes, and for elevator cables.

In many cases where regular six-strand hoisting ropes have failed to work economically, our **Extra Flexible Ropes** have given perfect satisfaction in points of strength, length of service and economy.

Special flexible ropes are also made with 37 wires to the strand.

Wherever more than ordinary flexibility in wire ropes is desired, or the use of small sheaves and pulleys is necessary, we heartily recommend our **Extra Flexible Ropes**, made of our special high-grade quality of crucible cast steel and plow steel, which are the very best materials possible to use in wire ropes.



# NEWHALL CHAIN FORGE & IRON CO.

90 WEST ST., NEW YORK

156 SECOND ST., SAN FRANCISCO

Manufacturers of Welded Chains of Every Description



Fig. 320

## STEAM SHOVEL AND DREDGE CHAINS, ALL SIZES

"TRIDENT"  
LOADING CHAIN



"WARWICK"  
DREDGE CHAIN

### CHAINS FOR:

CARS  
CRANES  
CONVEYORS  
DREDGES  
ELEVATORS  
HOISTS  
LOGGING  
MARINE  
RAILWAYS  
MILL TRUCKS  
POCKET  
WHEELS  
QUARRIES  
RAFTING  
SPROCKETS  
STEAM  
SHOVELS  
ETC.

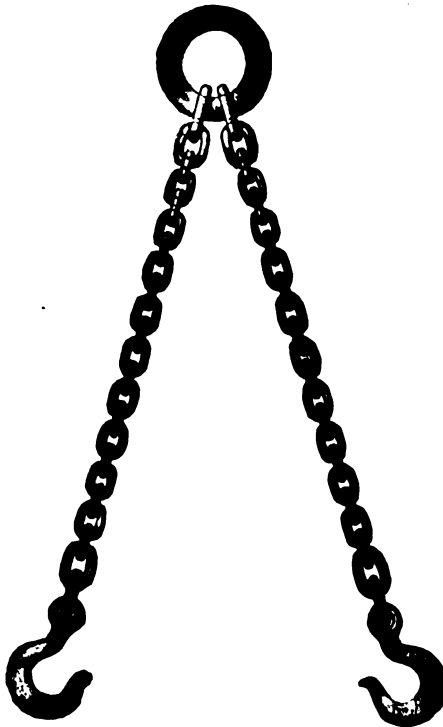


Fig. 355

## SLING CHAINS, ALL STYLES

Write for Catalogue.

DROP  
FORGINGS  
HAND  
FORGINGS  
CHAIN HOISTS  
CHOCKS  
CLEATS  
CLEVICES  
COLD SHUTS  
COMBINATION  
DRILL PRESS  
GUY CLAMPS  
HOOKS  
REPAIR LINES  
SHACKLES  
SWIVELS  
WIRE ROPE  
CLIPS

# G. L. STUEBNER IRON WORKS

HANCOCK ST. AND VERNON AVE.

LONG ISLAND CITY, NEW YORK, N. Y.

**Manufacturers of Hoisting Buckets, Narrow Gauge Cars, Wheelbarrows, Furnaces, Etc.**



**Turn-over and Bottom Dumping  
Buckets of All Types and Sizes; Steel  
Skips.**



**Flat, End and Bottom Discharge  
Industrial Cars and Track.**



**Push Carts for Handling Coal, Ores,  
Earth, Concrete, Etc.**



**Asphalt Heaters and Lead Melting  
Furnaces, Etc.**



**Catalogue No. 550**



**CATALOGUE SECTION  
PART III**

**Metals, Alloys and  
Other Materials**

233

**Pages 234-250**

## **A. ALLAN & SON**

**HARRISON, NEW JERSEY**

**Inventors and Sole Manufacturers of Allan Red Metal and Allan Bearing Bronze**

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### **BEARING BRONZE**

The addition of lead to bronze, where same is accomplished by a process that will assure the casting of an alloy of uniform physical structure, a bearing bronze is produced that will have exceptional wearing and anti-friction qualities.

Allan Bearing Bronze is our lead-copper-tin alloy, made of the proper proportions of virgin metals, so alloyed as to assure a uniform physical structure. An exceptionally high grade bronze for high speed and heavy duty service. The bronze that will cut cost and upkeep on your mill pinions.

### **ALLAN RED METAL**

234

This alloy is not strictly speaking a Babbitt metal, nor can it be classed as a bronze, it just fits in the intermediate field, to do such work where white Babbitt metals will not give satisfaction, as they readily change their form with an increase of temperature and yet conditions in many cases are such that it is impossible to use a bronze. Allan Red Metal combines the best qualities of the Babbitt and bronze alloys. It has the high anti-friction qualities of the Babbitt class with the temperature-resisting qualities of the bronze class.

Where will you find a bronze or Babbitt alloy that will stand up to the following service?

As shaft packing on steam turbines as a substitute for carbon.

As piston rod packing for locomotive service where temperatures run up to 650° Fahr.

As a bearing face for steam pistons with 150 pounds pressure and 200° super-heat.

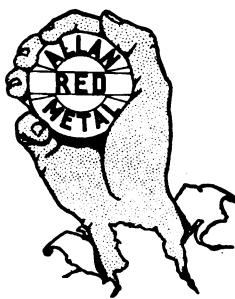
Allan Red Metal for many years has been meeting these service conditions and also overcoming troublesome conditions in crank pin, crosshead and motor bearings where white Babbitt metals have proven inefficient for the service conditions.

## A. ALLAN & SON

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TRADE MARK



TRADE MARK

For over a quarter of a century we have been manufacturing bearing alloys, Allan Red Metal and Allan Bearing Bronze, our lead-copper and lead-copper-tin bearing alloys. They are made by The Allan Process, invented by Andrew Allan, Sr., in 1876. This is the only process which makes possible the alloying of lead-copper and lead-copper-tin in any desired proportion and assures the production of castings of uniform physical structure.

235

Our new plant at Harrison, N. J., is the highest attainment in foundry construction and equipment and is under able metallurgical and mechanical supervision.

No orders too large or too small for prompt attention.

Estimates gladly furnished from blue prints.

Alloys sold in ingots and castings.

On long runs we prefer to make the necessary patterns.

On short runs we prefer to work from customers' patterns or we can furnish the patterns at nominal cost.

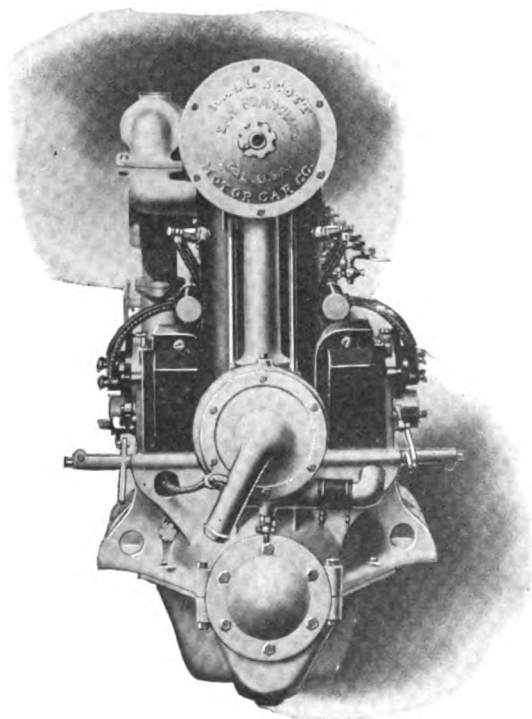
## AMERICAN BRONZE COMPANY

GENERAL OFFICES AND WORKS:

BERWYN, PENNSYLVANIA

Manufacturers of "Non-Gran" High Speed Bearing Bronze

---



### NON-GRAN IN THE HALL-SCOTT MOTOR

It is but natural that Non-Gran Bushings are found in Hall-Scott Motors.

Look over the specifications of any of the fine motors built in America and you will find Non-Gran Bushings at those important points where wear would be fatal and where resistance to wear is, therefore, all-important.

It makes no difference where these motors are built—New York, New Jersey, Ohio, Indiana, Michigan, Illinois, Wisconsin or California—their wear-subjected, non-adjustable bushings come from Berwyn, because in Non-Gran Bronze is found correct and adequate quality and the certainty of *maintained* uniformity.

# AMERICAN BRONZE COMPANY

**NON-GRAN**  
REGISTERED TRADE MARK

TRADE MARK



## FINISHED BUSHINGS

We specialize on the finishing of plain straight bushings and plain straight bushings with flange at one end. We undertake the finishing of these two specialties in long runs only.

We do not finish any shapes other than the above two, and we finish these only when the inside diameter is two inches or less.

Oil grooves, oil holes, slots, chamfers, etc., are provided as called for.

Our standard tolerances:  $\pm .0005$ " on diameters;  $\pm .005$ " on overall lengths;  $\pm .0025$ " on flange thicknesses. Work held to closer limits where required.

For quotations, note respective quantities on backs of your blue-prints. We furnish all necessary pattern equipment.



## CASTINGS

We cast Non-Gran to any pattern of any size, with no cores, straight cores or intricate cores as required.

Use brass shrink rule and allow  $\frac{1}{16}$ " stock all over for finishing on castings up to about 3"—more, in proportion, on larger castings.

On short runs we prefer to work from customers' patterns.

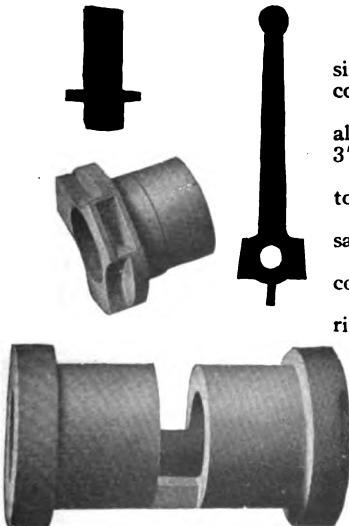
On long runs we prefer to make the necessary pattern equipment.

For this work we charge merely our own costs for the labor and material involved.

All Non-Gran Castings are sandblasted and rigidly inspected before shipment.

We supply Non-Gran Castings in any quantities from one up.

For quotations, send patterns or sketches and state quantities.



## STANDARD 12" BARS

Outside diameters  $\frac{1}{2}$ " up to 5" by eighths.

Inside diameters  $\frac{1}{2}$ " up to 3" by eighths.

Supplied in any combinations of the above outside and inside diameters.

Write for list of standard combinations of O. D. and I. D. which are carried in stock for immediate shipment from Berwyn or from Official Non-Gran Bar Distributors in all important cities.

Because of high tin contents Non-Gran cannot be rolled or drawn but must be cast to pattern. In ordering Non-Gran Bars therefore allow  $\frac{1}{16}$ " stock all around to permit of your machining down to the finished dimensions of the part.

## THE BUNTING BRASS & BRONZE CO.

729 SPENCER ST., TOLEDO, OHIO

### BUNTING'S PATENTED MACHINED BRONZE BUSHINGS AND BEARINGS

We are in a position to offer Bronze Bushings and Bearings Completely Machined and ready for Assembly at a saving in cost of from 10% to 50% over the cost of the castings and machine work.

We have demonstrated the above fact to more than 400 concerns, whom we supply with our material, and who are in most cases the largest and most prominent companies manufacturing Machine Tools, Automobiles, Automobile Parts, Engines, Agricultural Machinery, Etc.

These users are ready to testify that we are able to produce these parts in quantity, machined complete, far more cheaply and of a much better grade of material and workmanship than they could do it themselves.

We operate our own bronze foundry and use specially designed semi-automatic machinery in the manufacture of our product.

Bunting Standard Phosphor Bearing Bronze used in all Bushings, unless otherwise specified, in which case special price applies. Bunting Bearing Metal is the highest grade possible to secure.

We require NO PATTERNS OR TOOLS.

We use your own composition if you prefer.

We quote prices from Blue Prints, Samples or send us dimensions.

The Above Illustration Shows Several  
Styles of Our Bronze Bushings

**Directions for Ordering:** Dimensions—All inside and outside dimensions must be furnished in decimals, thus, 1.503". Diameter dimensions guaranteed to be within .001". All dimensions given in common fractions will be held to commercial accuracy, viz., .01".

*Catalogue on request*



# LUMEN BEARING COMPANY

BUFFALO

Brass Founders

## LUMEN BRONZE (for bearings)

20% lighter than a phosphor bronze of the same bearing capacity—and  
30% less expensive on a high metal market.

	Sand Cast	Chill Cast
Tensile strength	32-36000	40-45000
Elongation	0%	0%
Brinell Hardness	114-119	119-124
Specific Gravity	6.9	
Weight per cubic inch	0.25	
Shrinkage	$\frac{3}{16}$ "	

## MANGANESE BRONZE (for strength parts)

	Sand Cast	Chill Cast
Tensile Strength	70-75000	75-80000
Elongation	22%-30%	25%-32%
Brinell Hardness	109-119	119-130
Specific Gravity	8.4	
Weight per cubic inch	0.303	
Shrinkage	$\frac{1}{4}$ "	

## GEAR BRONZE (for worm drives)

	Sand Cast	Chill Cast
Tensile Strength	30-35000	46-52000
Elongation	5%-8%	4%-7%
Brinell Hardness	67-77	96-105
Specific Gravity	8.5	
Weight per cubic inch	0.307	
Shrinkage	$\frac{1}{8}$ "	

## PHOSPHOR BRONZE (for bearings)

	Sand Cast	Chill Cast
Tensile Strength	26-32000	36-42000
Elongation	4%-8%	2%-6%
Brinell Hardness	61-70	80-89
Specific Gravity	8.9	
Weight per cubic inch	0.322	
Shrinkage	$\frac{1}{8}$ "	

Physical data are based on test bars cast according to standard methods.

## SPECIAL BRONZES

We are prepared to meet any commercial specifications and to produce in our castings the highest physical qualities consistent with any chemical formula. We maintain a fully equipped laboratory for the purpose of controlling our alloys.

## To Engineers

We invite you to visit our plant at any time. Telephone Oxford 77—  
address 197 Lathrop St.

## THE AMERICAN BRASS COMPANY

WATERBURY, CONNECTICUT, U. S. A.

### MILLS AND FACTORIES

Ansonia Brass & Copper Branch, Ansonia, Conn.    Coe Brass Branch, Torrington, Conn.  
Benedict & Burnham Branch, Waterbury, Conn.    Coe Brass Branch, Ansonia, Conn.  
Waterbury Brass Branch, Waterbury, Conn.        Kenosha Branch, Kenosha, Wis.

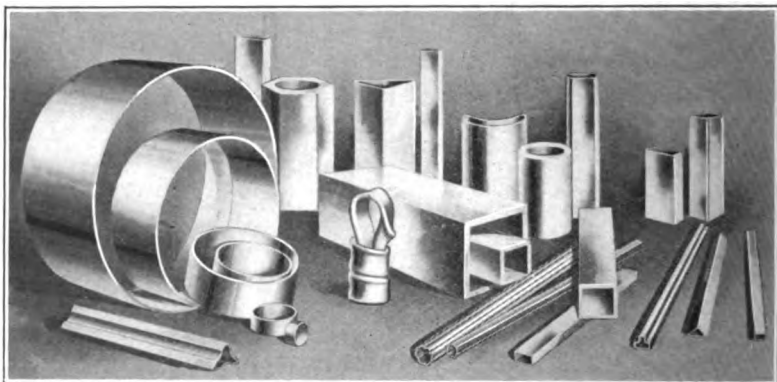
### BRASS AND COPPER TUBES FOR EVERY ENGINEERING REQUIREMENT

Admiralty and other special grades of Condenser Tubes.

Ferrule Tubing, Heater Tubing, Pump Tubing.

Tobin Bronze and Phosphor Bronze Tubing for Bearings.

Brass and Copper Tubing in Iron Pipe and Plumbers' sizes.



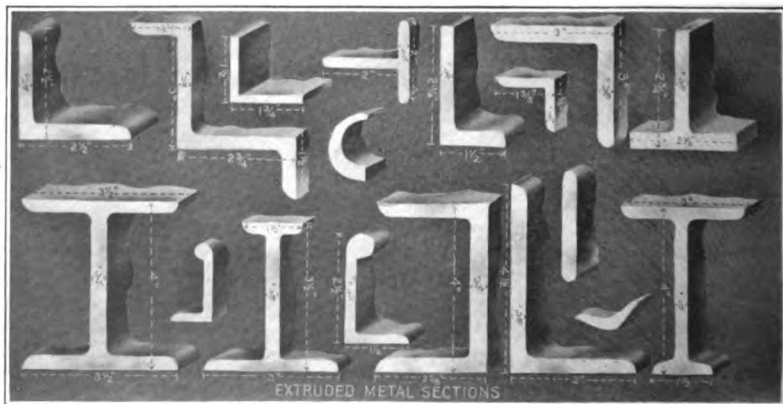
### HIGH TENSILE STRENGTH RODS AND BARS ADAPTABLE FOR A GREAT VARIETY OF ENGINEERING PURPOSES

Tobin Bronze, remarkable for its Toughness and Resistance to Corrosion.

Free Cutting Rods, Naval Brass and Phosphor Bronze Rods.

Extruded Irregular Shaped Bars, Heavy Angles, Channels, and Mouldings made from forgeable alloys of both Brass and Bronze.

Turbine Blading and Calking Materials.



# BAYONNE CASTING COMPANY

BAYONNE, N. J.

Monel Metal Castings: Rods, Bars, Wire (Round and Flat)

Monel Metal Forgings: Bolts, Nuts, Ribbon

## SPECIFY MONEL METAL

—for all parts requiring great strength plus non-corroding qualities. Monel Metal with its high percentage of nickel and copper together with other metals, its high tensile strength and non-corroding properties—greatly excels Manganese, Tobin or Phosphor Bronze. Especially adapted for marine work and engineering construction that comes in contact with salt water and for valves and fittings subject to superheated steam. Monel Metal looks like pure Nickel and takes the same finish.

*Castings made from Customers' Patterns.*

One-piece castings made up to 25,000 lbs. Some of the specific uses to which Monel Metal castings have been applied are—propellers for U. S. Navy and private yachts—pump linings—steam turbine nozzles—superheated steam valve fittings—dairy machinery—gear blanks—thermometer wells—deck fittings—radiator parts—washers—nuts—etc. Monel Metal rods furnished for bolt and nut stock, steam turbine parts, drop forging stock, motor boat shafting, pickle pins, valve stems, etc. Monel Metal wire has hundreds of various applications.

*Consult our Engineering Department about your special manufacturing problems.*

Send for descriptive literature



## TESTS OF CASTINGS

### TENSILE

(Average of 172 Heats Tested for Isthmian Canal Commission)

Yield Point.....	37,093 lbs. per sq. in.
Tensile Strength.....	72,281 lbs. per sq. in.
Elongation in 2 in.....	34%
Reduction of Area.....	32"

### COMPRESSION

Elastic Limit.....	12,000 to 25,500 lbs. per sq. in.
--------------------	-----------------------------------

## TESTS ON RODS

### TENSILE

Averages of last fifty tests of each of the three divisions as given:

	Yield Point Lbs. per sq. in.	Ultimate Tensile Strength Lbs. per sq. in.	% Elongation in 2"
Up to 1".....	57,092 lbs.	90,342 lbs.	42 %
1" to 2½".....	58,306 lbs.	90,290 lbs.	38.5 "
Above 2½".....	46,769 lbs.	84,232 lbs.	42.9 "

### TORSIONAL (AVERAGE)

Shearing stress—Lbs. per sq. in. on remotest fibres:	
At Elastic Limit.....	31,796
At Ultimate Load.....	79,053

### COMPRESSION

Elastic Limit.....	25,500 to 32,000 lbs. per sq. in.
--------------------	-----------------------------------



## DOEHLER DIE-CASTING CO.

MAIN OFFICE AND EASTERN PLANT  
BROOKLYN, N. Y.

Western Plant  
TOLEDO, OHIO

New Jersey Plant  
NEWARK, N. J.

Producers of Die-Castings in Brass and Bronze, Aluminum and White Metal Alloys; Die-Cast Babbitt and Babbitt Lined Bronze Bearings



Die-Cast Bronze Gear

The importance of die-castings in present day manufacture is generally recognized throughout the industry. The economies effected by their use by delivering a finished part, however intricate in design, practically ready for assembling requiring little or no machine finishing and the increased production thereby made possible, are now well known.

Die-Castings, however, to satisfactorily perform the functions required of them, must possess certain requisites; lacking which, their use seriously jeopardizes the value of the product they are to become part of.

DOEHLER DIE-CASTINGS ACCOMPLISH EVERY ESSENTIAL DIE-CASTING REQUIREMENT. They are produced from high grade virgin metals of our own alloying by an organization whose sole aim for a decade has been the exclusive manufacture of die-castings, equipped with every facility for their successful manufacture.



Aluminum Die-Cast Typewriter Part

### Aluminum Die-Castings

By our development of the process for die-casting aluminum we immeasurably broadened the die-casting possibilities. The accuracy, uniformity and sharp outline that characterize our white metal products are also obtained in our Aluminum Die-Castings with the additional feature of a high tensile strength combined with lightness of weight. This product has within the last three years become an important factor in production economy displacing to a great extent the use of machine finished parts where, owing to their limitations, white metal die-castings could not be satisfactorily employed.

### Brass Die-Castings

Our notable achievement within the past year, that of successfully die-casting brass and bronze on a commercial scale, has been another step in the same direction—that has made this the leading and largest die-casting concern in the world.



Aluminum Die-Cast Balance Beam

## THE STEWART MFG. CO.

WELLS ST. BRIDGE, CHICAGO

**Manufacturers of Die-Cast Parts in White Brass and Aluminum Alloys; also Reinforced Babbitt Bearings**



**DIE-CASTINGS  
Of Quality**



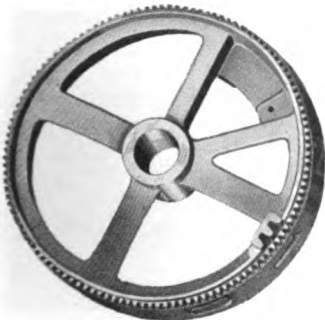
243

Die-castings made by the Stewart Process are superior in every way. They excel in strength, accuracy, uniformity and finish.

Stewart die-castings are made in white brass and aluminum alloys.

Advanced methods combined with unlimited manufacturing facilities, including a large die-making department, enable us to make quick deliveries with large production.

It will pay you to investigate the Stewart Process.



# **ALUMINUM COMPANY OF AMERICA**

**PITTSBURGH, PA.**

## **BRANCH OFFICES**

**BOSTON  
CHICAGO  
CLEVELAND**

**DETROIT  
KANSAS CITY  
NEW YORK  
WASHINGTON**

**PHILADELPHIA  
PITTSBURGH  
ROCHESTER**

**CANADA, Northern Aluminum Co., Ltd., Toronto  
SAN FRANCISCO, Pierson, Roeding & Company  
LATIN AMERICA, Aluminum Company of South America  
ENGLAND, Northern Aluminium Co., Ltd., London**

**Aluminum: Ingot, Casting Alloys, Sheet, Foil, Rod, Wire, Tubing, Mouldings, Fittings, Electrical Conductors, Bronze Powder and Lithograph Plates**

---

## **FABRICATED ALUMINUM**

Automobile hoods, fenders and stampings. Tanks, pans, coils, pipe lines and miscellaneous apparatus for chemical, fruit juice and other manufacturers.

## **ELECTRICAL CONDUCTORS**

The use of Aluminum for electrical conductors is rapidly increasing. Its properties make its use desirable in electrical construction and it is now being successfully used for High Tension Transmission Wire, Railway Feeders, Bus-Bars, etc.

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Descriptive matter, containing valuable information for the user of Aluminum in any of its various forms, will gladly be sent to those interested.

# **UNITED LEAD COMPANY**

**111 BROADWAY, NEW YORK CITY**

**Offices in All Principal Cities**

**Specialists in Lead Products**

---

**LEAD WOOL**

**LEAD PIPE**

**LEAD ROPE**

**TRAPS AND BENDS**

**SHEET LEAD**

**TIN PIPE**

**LEAD, TIN, BRASS AND COPPER LINED IRON PIPE**

**ACID RESISTING VALVES**

**ULCO LEAD ROPE:** For making Metallic Packing we put up Lead Rope in smaller sizes. This material is sold lubricated or not, as requested. For stuffing boxes and valve stems the lead rope should be thoroughly saturated with graphite and oil. For making gaskets it is wrapped in cheese cloth and saturated with graphite and oil.

245

**LEAD WOOL:** For calking cast iron and riveted steel pipe for gas and water mains. Since it is not necessary to heat it, it cannot shrink like a cast lead joint. Used extensively for high pressure mains.

**LINED PRODUCTS:** Lead, tin, brass and copper lined iron pipe—Fittings, lead and tin lined, flanged or threaded. All of this class of products lined by the United process which inseparably bonds or fuses the two metals. Let us help you figure on your Water, Acid, or Food Product piping problems. Write for catalogue.

**BABBITT METALS:** All lead, tin, antimony, arsenic, copper alloys for use as Bearing or Casting Metals.

Write for catalogue of the particular product in which you are interested.

*"Anything Made of Lead"*

# AMERICAN VULCANIZED FIBRE CO.

Established 1873

WILMINGTON, DELAWARE

## VUL-COT FIBRE

**Manufacture.**—In the manufacture of fibre there are three factors absolutely essential to mechanical strength and electrical insulation: 1. Pure Raw Material. 2. Experience and care in the process of making. 3. Freedom from chemicals in the finished product.

American Vulcanized Fibre is made from raw stock free from iron, bone or other impurities.

The processes of manufacture are accurately and scientifically controlled.

The finished product undergoes rigid chemical analysis and physical test.

As the sole makers of *Original* Vulcanized Fibre, we naturally know how to make the very finest fibre and constant endeavor produces a better and more uniformly excellent product each year.

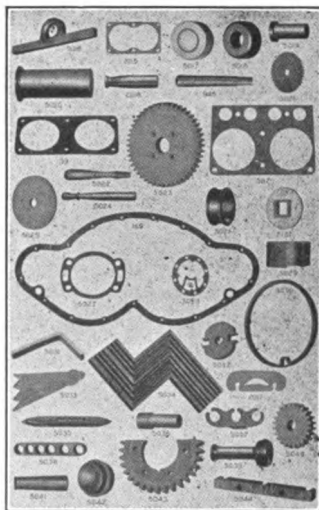
The result is a tough, homogeneous, horn-like material with the following valuable characteristics:—

**Characteristics:** Tensile strength 9,000–14,000 lbs. per sq. in., Compressive strength 32,000–37,000 lbs. per sq. in., Resistance to shearing 9,000–13,000 lbs. per sq. in., Specific Gravity 1.2–1.5, Electrical Rupture 150–400 volts per 1/1000 inch of thickness.

COMPARATIVE TABLE	Pounds per cu. ft.	Effect of Oil, etc.	Effect Rodents, Vermín, etc.	Brittle or Tough	Effect of Age
VULCANIZED FIBRE.	85	None	None	Tough	Improves
Porcelain, etc.....	144	None	None	Brittle	.....
Hard Rubber.....	150	Deteriorates	.....	Brittle	Deteriorates
Rawhide, Leather, etc...	Varies	Deteriorates	Destroy	Tough	Deteriorates

### Partial List of Applications

Adjusters (Cord)	Mirror Backs
Baskets (Hop)	Packings
Baskets (Mill)	Pinions (Noiseless)
Baskets (Waste) "Vul-Cot"	Rings
Bases (Switch)	Rods
Bearings (Plain)	Rollers
Thrust, etc.)	Rolls (Pinking)
Bobbins (Coil)	Seats (Chair)
Boxes	Shims (Switch)
Bumpers (Textile)	Shoe Horns
Bushings	Shoes (Brake)
Cans (Roving)	Staples (Insulating Saddle)
Checks (Factory Time)	Straps (Brake)
Cleats	Switch Bars
Conduits (Interior)	Tacks (Insulated Wiring)
Discs (all kinds)	Tags
Ferrules (Condenser, Handle)	Telephone Cleats
Frames (Bolster Case)	Tie Plates (Railroad)
Frictions	Trucks (Mill)
Gaskets (Oil-proof)	Tubes
Gears (Noiseless)	Valves (Pumps)
Gear Blanks	Washers, (Friction, Thrust, Insulating, Compression,
Gibs (Engine, Crossheads)	Cock, Pipe Union, Car-
Handles	riage Axle, Car Box)
Heads (Magnet, Bobbin, Spool)	Wedges (Armature)
Insulation	Wheels
Insulators (Rail Joint)	Wiring Cleats
Linings (Clutch) "Auto"	And many others.



A moment's thought will undoubtedly suggest to you applications not named above which will improve or cheapen your product or facilitate its manufacture.

*Our Development Department is at your service to solve your problems, answer your inquiries or quote you prices, without obligating you in the slightest.*





# DIAMOND STATE FIBRE COMPANY

PRINCIPAL OFFICE: BRIDGEPORT, PA.

## BRANCH OFFICES:

ATLANTA, GA.	NEW YORK CITY	ST. LOUIS, MO.	CLEVELAND, O.
ROCHESTER, N. Y.	SAN FRANCISCO, CAL.	DETROIT, MICH.	MILWAUKEE, WIS.
CHICAGO, ILL.	NEW ORLEANS, LA.	BALTIMORE, MD.	GREENVILLE, S. C.
BOSTON, MASS.	PHILADELPHIA, PA.	SEATTLE, WASH.	PITTSBURGH, PA.

Manufacturers of Diamond Vulcanized Fibre in All Forms



*The Diamond State Fibre Co. is the largest manufacturer of Fibre in the world. The DIS-FI-CO Trademark is the guarantee of Superiority in Vulcanized Fibre products.*

## UNWORKED DIAMOND FIBRE

Orders of any size can be filled from stock in the standard sizes of **SHEETS, RODS and TUBES**. The mills and warehouses are strategically located so that time may be saved by shipping from the mill nearest the customer.

## MACHINED PARTS

Diamond Fibre machined parts and specialties include gears, pinions, handles, discs, washers, gaskets, packings, switch bars, track insulation, etc., etc.

## FRICTION BOARD, SOFT FIBRE, INSULATING PAPERS, ETC.

DIAMOND INSULATION and DISFICO cover fully the various requirements of the mechanical and electrical trade.

## TRUCKS, MILL AND FACTORY BOXES, ETC.

Diamond Fibre Trucks, Waste Paper Baskets, Boxes, Barrels, etc., will not dent and bend like steel. Fibre Trucks in use 30 years are still in good condition.

## DEVELOPMENT DEPARTMENT

The Development Department of the Diamond State Fibre Co. will take up experimental work for you and tell you if fibre can be substituted to your advantage for some other more expensive material. Address all communications Development Department, Bridgeport, Pa.

# UNION DRAWN STEEL COMPANY

GENERAL OFFICES: BEAVER FALLS, PA.

WORKS: BEAVER FALLS, PA. and GARY, IND.

COLD DRAWN OR TURNED AND POLISHED	{	SHAFTING	{	Bessemer
		SCREW STEEL		Open Hearth
		ALLOY STEELS		Nickel—1 % and 3 ½ %
		(Heat treated or not)		Nickel Chromium
				Chromium—Vanadium, Etc.
		AXLES, PISTON RODS		
		SPECIAL SHAPES		
		SPECIAL CASE-HARDENING STEELS		

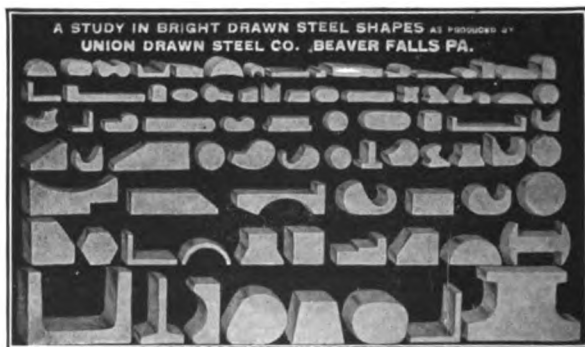
Cold Finished Bessemer, Open Hearth,  
Crucible and Electric Furnace Steels

**Shafting:** We use only the best quality of Soft Steel and are manufacturing under recent patents, covering machinery and appliances, by a process superior to anything known for producing great accuracy, a highly polished surface and the necessary straightness.

**Piston and Pump Rods:** Of special steels up to 60 or 70 feet long.

**Screw Steels:** For Automatic machine uses at high speeds.

**Elevator Guides:** Cold Drawn, Straight, with matched joints.



**Special Shapes of Cold Drawn Steel** made to meet your specifications; often more economical than castings and forgings, where finished parts are needed.

*Complete Warehouse Stocks Carried at*

NEW YORK

DETROIT

CINCINNATI

PHILADELPHIA

CHICAGO

Branch Sales Offices at BOSTON and BUFFALO

## EDGAR T. WARD'S SONS

50 FARNSWORTH STREET, BOSTON, MASS.

Cold Rolled Strips, Bars, Sheets, and Tubes, Tool Steels, Fine Steel Wires

### HARDENED, TEMPERED, POLISHED AND BLUED STEEL STRIPS

Our tempered stock is the finest Swedish Steel exact to thickness and width, nicely blued (except marked † Bright), and of an excellent even temper. No other stock can be relied upon for such uniformity of temper and accuracy to gauge.

#### In Stock

2500 sizes  $\frac{1}{16}$ " to 12" wide, .0015 to .095 thick.

### COLD ROLLED TOOL STEELS ANNEALED

We carry in stock cold rolled tool steel, bright annealed (free from Scale) for small cutters, saws, springs, etc.

2" x .001" and .002"  
3 $\frac{1}{4}$ " x .003", .004", .005" } In coils  
4" x .006" to .057"  
5 $\frac{1}{2}$ " x .058", .060, .0625, .065, .070, .072, .075, .077,  
.083, .095, .101, .106, .109, .115, .120, .125, .134, .158  
in 6 ft. lengths.

Hard Rolled, .005" to .051" in coils 3 $\frac{1}{8}$ " wide.

**Steel for Band, Butcher and Hack Saws; Steel Pens and Tapes.**

**Soft Bright Cold Rolled Strip Steel.**

Dead Soft to bend both ways of grain.

For stamping, deep drawing, shims, washers, machine parts, etc.

.012" to .312" thick widths to 12".

**Sq. Edge Flats,  $\frac{3}{16}$ " x  $\frac{1}{8}$ " to 3" x 2".**

**Round Edge Flats,  $\frac{1}{8}$ " x .062" to 1" x .125".**

**Flat Square Edge Cold Drawn Tool Steel,  $\frac{1}{8}$ " x  $\frac{1}{16}$ " to  $\frac{5}{8}$ " x  $\frac{3}{8}$ ".**

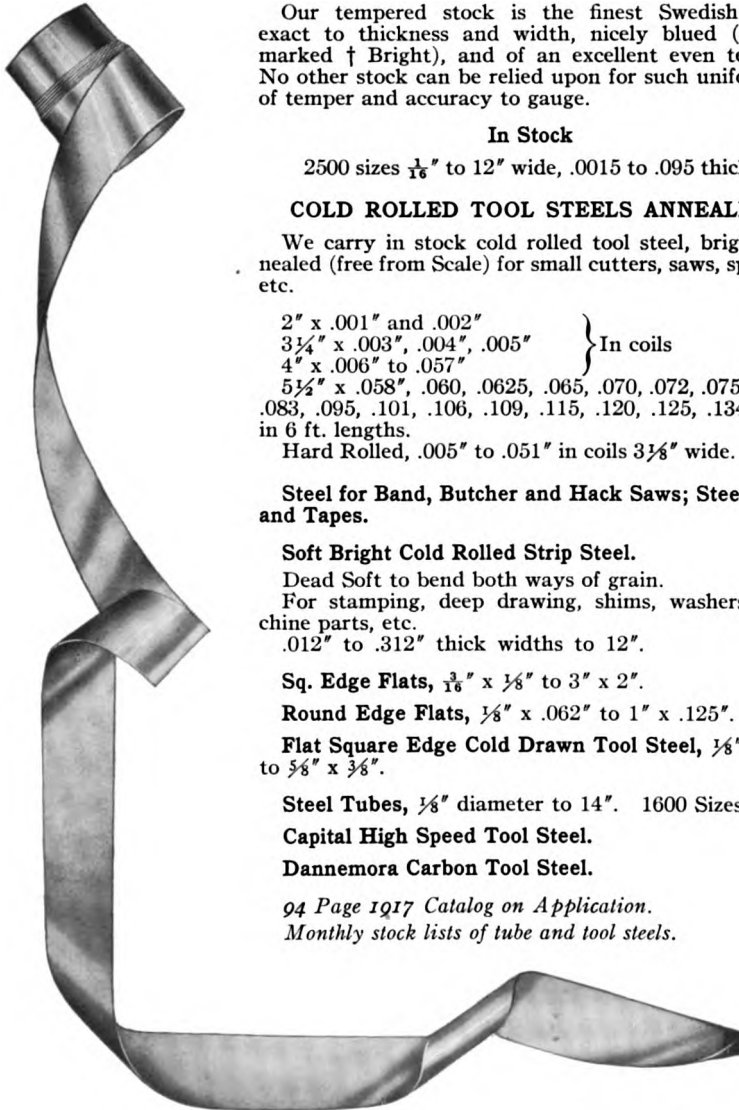
**Steel Tubes,  $\frac{1}{8}$ " diameter to 14". 1600 Sizes.**

**Capital High Speed Tool Steel.**

**Dannemora Carbon Tool Steel.**

94 Page 1917 Catalog on Application.

Monthly stock lists of tube and tool steels.



# WHEELOCK, LOVEJOY & COMPANY

NEW YORK  
23 CLIFF ST.

CAMBRIDGE  
128 SIDNEY ST.

Tool Steel for Every Purpose

*Agents*  
THOMAS FIRTH & SONS, LTD.,  
SHEFFIELD, ENG.

*Cutlery and Saw Sheet Steel*

GLOBE WIRE CO., LTD.,  
SHARPSBURG, PA.

*Polished Drill Rods, Needle Wire  
Drawn Steel in Special Shapes*

*Agents*  
FIRTH-STERLING STEEL COMPANY,  
PITTSBURGH, PA.

*Makers Tool Steel*

BRIGHTMAN MFG. CO.,  
COLUMBUS, OHIO

*Turned, Ground and Polished  
Shafting and Screw Stock*

THE REEVES MFG. CO.,  
CANAL DOVER, OHIO  
*Blue Sheet Steels*

## HY-TEN STEEL

This steel is of high tensile strength and elastic limit, especially intended for machine tool parts where good wearing qualities combined with great strength and toughness are essential.

A complete stock is carried in warehouses for prompt shipment.

## FIRTH-STERLING "BLUE CHIP" HIGH SPEED STEEL

Suitable for Lathe and Planer Tools, Milling Cutters, Drills, Reamers, Taps, Cutting and Blanking Dies, etc.

"Blue Chip" High Speed Steel is carried in stock in the following sizes and shapes:

SQUARES,  $\frac{1}{4}$  in. to  $\frac{3}{4}$  in. Hard Steel ready for use.  
 $\frac{1}{4}$  in. to 3 in. Annealed.

ROUNDS,  $\frac{1}{4}$  in. to 10 in. Annealed.

FLATS,  $\frac{3}{8}$  in. x  $\frac{1}{4}$  in. to  $5\frac{1}{2}$  in. x  $\frac{1}{4}$  in. Annealed.

$\frac{1}{2}$  in. x  $\frac{1}{4}$  in. to  $3\frac{1}{2}$  in. x 2 in. Annealed.

Special sizes can be secured promptly from the mill.

## FIRTH-STERLING TOOL STEELS

Other high grade Firth-Sterling Steels carried in stock by Wheelock, Lovejoy and Company are in part as follows:

*Firth's Best Tool Steel* (Water Hardening), a strictly high grade carbon tool steel for general service.

*Firth-Sterling Special Steel.* For Punches, Dies, Chisels, Blacksmith Tools, Shear Blades, Rivet Snaps and all Shop Work.

*Sterling Tool Steel.* This steel is made to compete with the lower grades on the market, and will compare favorably with them. Carried in stock in Rounds, Flats, Squares and Octagons.

## ALLOY STEELS

To meet the increased demand for steels that are more effective than carbon steels, and of a different character from High Speed Steel, we have developed the following which we now recommend for various purposes:

Firth-Sterling "Extra Special" Steel  
Firth-Sterling "Double Special" Steel  
"Hold Fast" Magnet Steel

"C Y W Choice" Steel  
"A W Special" Steel  
Firth-Sterling Finis Steel

**CATALOGUE SECTION  
PART IV**

**Metal Working Machinery  
Machine Tools and Accessories  
Shop Equipment**

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**Pages 252-336**

# E. W. BLISS COMPANY

19 ADAMS STREET, BROOKLYN, N. Y.

Builders of Sheet Metal Working Machinery



**"BLISS" INCLINABLE POWER PRESSES**—18 sizes, weighing from 500 to 8,000 lbs., either as "Flywheel" or "Geared" Presses. Adapted for tin, sheet brass, sheet steel work, etc.

PRESSES, DIES, SHEARS,  
DROP HAMMERS,  
DOUBLE SEAMERS,  
SPECIAL MACHINERY

1857



1917



**"STILES" AUTOMATIC DROP HAMMERS**—Built in 15 sizes. Adapted for forging or stamping. Hammers weigh from 100 to 3000 lbs.

Tin and Enamel Ware Machinery

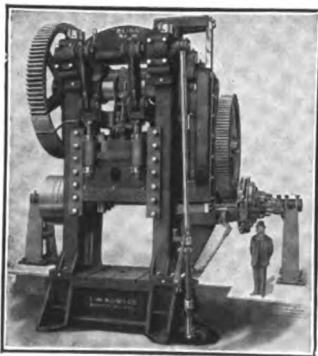
Metal Package Machinery,

Automatic Tin Can Machinery

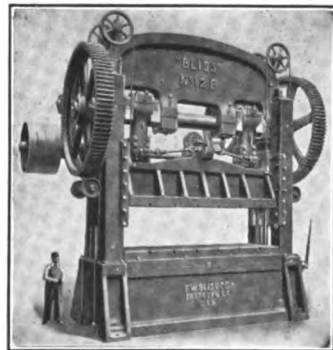
Electrical Parts Machinery

Automobile Parts Machinery

Drop Forging Machinery



**"BLISS" TOGGLE DRAWING PRESSES**—Built in over 20 sizes, weighing from 5,600 to 165,000 lbs. For drawing shells from all kinds of sheet metal.



**"BLISS" STRAIGHT-SIDED DOUBLE CRANK PRESSES**—Built in over 150 different types and sizes, weighing from 2,500 to 260,000 lbs. For heavy blanking, stamping and punching of large dimensions.

**"BLISS" DOUBLE SEAMERS** (not illustrated)—Built in over 30 different types and sizes, weighing from 275 to 7,500 lbs. For double seaming the tops and bottoms on articles of square, round, oval and irregular shapes.

**"STILES" PUNCHING PRESSES** (see opposite page)—11 sizes, weighing from 550 to 13,000 lbs. Adapted for the manufacture of general hardware, electrical goods, etc.

**"BLISS" KNUCKLE JOINT EMBOSSEING PRESSES** (see opposite page)—Built in 12 sizes and various styles, weighing from 2,700 to 110,000 lbs. and capable of exerting pressures ranging from 30 to 1,500 tons.

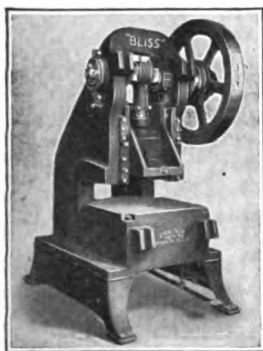
*Catalogue of any line of our machines sent on request.*

# E. W. BLISS COMPANY

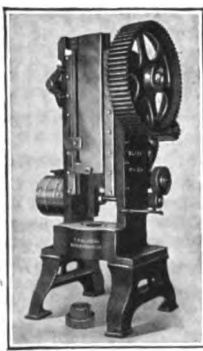
Our Product Includes **MACHINERY AND DIES** for the Economical Manufacture of the Following Sheet Metal Goods:

Agricultural Implements	Drip Pans	Lamps	Roofing
Albums	Door Knobs	Lanterns	Rubber Cups
Aluminum Ware	Drop Forgings	Lard Pails	Satchel Frames
Armature Disks and Segments	Druggists' Tinware	Locks	Speaking Tubes
Automobile Parts	Dust Pans	Match Boxes	Silver Ware
Bicycle Parts	Electrical Goods	Meat Cans	Sheet Steel Sinks
Bird Cages	Elevator Buckets	Medals	Shingles (Metal)
Bottle Caps and Capsules	Enamel Ware	Metallic Ceiling	Shovels
Brass Goods	Expanded Metal Laths	Metal Laths	Spoons
Brittania Ware	Fish Cans	Metal Radiators	Sheet Steel Stoves
Buckles	Forks	Musical Instruments	Steel Barrels
Burners	Fruit Cans	Oil Cans	Stove Trimmings
Butter Tins	Fry Pans	Oil Stoves	Thimbles
Cash Registers	Furniture (Metal)	Perforated Metal	Tin Boxes and Cans
Cigarette Boxes	Gas Fixtures	Paint Cans	Tobacco Boxes
Clocks	Gas Ranges	Paint Tubes	Toys
Coal Hods	Gongs	Petroleum Cans	Trunk Trimmings
Collapsible Tubes	Gun Parts	Pick-eyes	Typewriters
Cooking Utensils	Hammers	Pieced Tinware	Vapor Stoves
Coins	Hardware	Plated Ware	Varnish Cans
Cornice Work	Harness Trimmings	Playing Cards	Vegetable Cans
Cuspidors	Hinges	Powder Kegs	Water Coolers
Cutlery	Horse Shoes	Range Boilers	Water Pails
Dental Instruments	Jewelry	Range Parts	Watches
Dinner Pails	Kitchen Boilers	Reflectors	Wash Tubs
	Kitchen Utensils	Refrigerators	Zinc Work

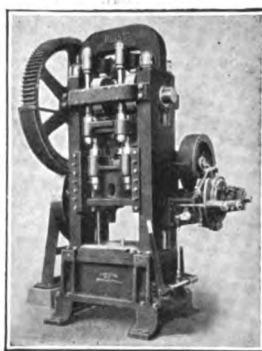
And Many Other Staple and Special Lines of Goods



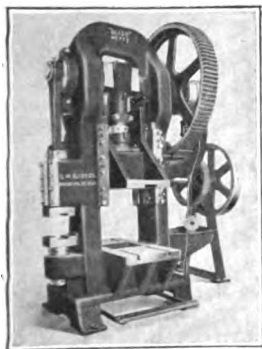
Cut Back Frame



Reducing Press



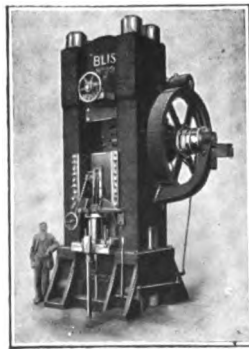
Double Action Cam



Trimming Press



"Stiles" Deep Throat



Knuckle Joint

## THE LONG & ALLSTATTER CO.

HAMILTON, OHIO, U. S. A.

**Manufacturers of Power Punches and Shears**

---

**POWER PUNCHING & SHEARING MACHINERY  
COPING MACHINES—STRUCTURAL PUNCHES  
RIVETING MACHINES—TIRE WELDING MACHINES  
ARMATURE DISC NOTCHING MACHINES  
HELVE HAMMERS**

One of the pioneers in their line whose tools may be found in most of the larger and more important metal-working establishments in our own country and many in Europe.

To those familiar with the trade, the name of this firm is a synonym for quality workmanship, efficiency and durability.

### **PUNCHING MACHINES SHEARING MACHINES**

A complete line of open-throated type, large and small, single- and double-ended, belt, stream or electrically driven (customer's option); a carefully graduated schedule for general purpose use, with modifications in endless variety for special work of all kinds.

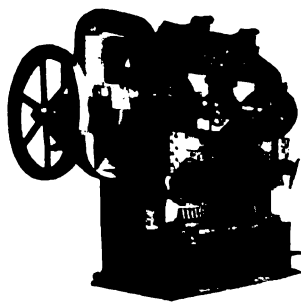
### **MULTIPLE PUNCHES GATE SHEARS**

Varying in width between housings and depth of throat to suit customer's requirements; to punch any number of holes, in groups or in rows, with fixed or adjustable centers, or cut off and trim plates or sheets of any width or thickness.

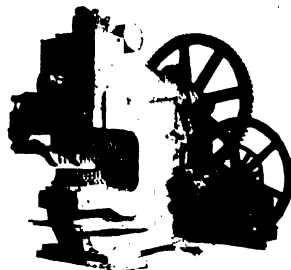
### **COPING MACHINES STRUCTURAL PUNCHES**

A full line, for coping and punching large and small structural sections (beams, channels, angles, etc.) of all kinds and sizes with the widest range of equipment.

*Write us regarding your problems in punching and shearing—correspondence solicited. Estimates furnished on request. If interested, you may have a catalogue for the asking.*



**Multiple Punch**



**Structural Iron Punch**



**Horizontal Punch and Bending Machine**



## WILLIAMS, WHITE & CO.

MOLINE, ILLINOIS, U. S. A.

PITTSBURGH OFFICE  
808 House Building

NEW YORK OFFICE  
C. H. Holbrook  
30 Church St.

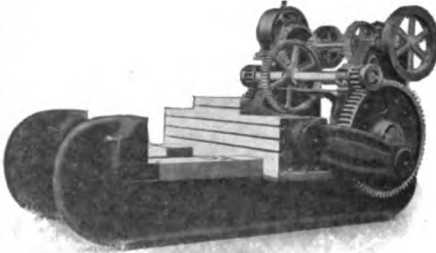
DETROIT OFFICE  
J. C. Austerberry  
924 Dime Bank Bldg.

CHICAGO OFFICE  
933 Monadnock Block

### Forging, Punching and Shearing Machinery; Coaling Stations

**BULLDOZERS:** Nearly forty years of Bulldozer manufacturing. These machines are used for an incredible number of purposes. General purpose Press with practically unlimited possibilities. Built in ten sizes, and two types.

**YEAKLEY VACUUM HAMMERS:** Recent and important improvements place this hammer at the head of Forging Hammers, both in power and control. Speed of blow is maintained, forging both light and heavy. Built in sizes from 40 to 650 lbs. Adaptable to motor drive.



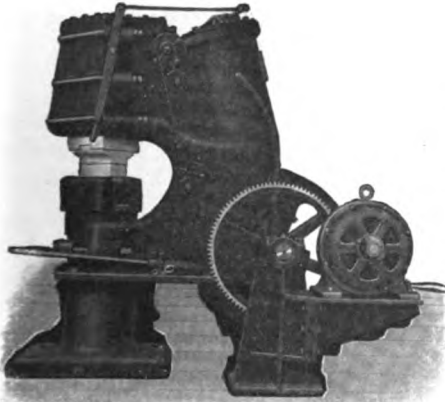
Bulldozer

**JUSTICE SPRING HAMMER:** Silico manganese steel springs furnished.

**MOLINE HELVE HAMMER:** Extra heavy in design.

**BOARD DROP HAMMER:** Very much improved. Exceptionally easy of operation and large output.

**CRANK (OR ROPE LIFT) DROP HAMMERS:** Stand very severe service with comparatively small upkeep. Particularly adapted to the carrying of large dies, for bending, shaping, forming and straightening. Made in three styles of Lifters—Sandage, Ratchet and Peck.



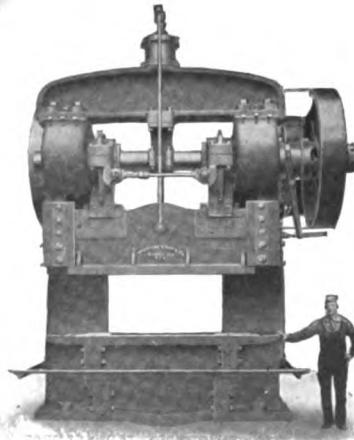
YEAKLEY Hammer

**MULTIPLE PUNCHES:** These machines are made in nine sizes with varying lengths and throats. Special adaptations for special work furnished. Machines range in weight from 5,000 to 250,000 lbs.

**PUNCHING AND SHEARING MACHINES** "C" type, Double and Single End Machines. Open-fronted Bar Shears, and Guillotine Shears.

**COPING AND STRUCTURAL PUNCHES AND SHEARS:** Complete line of the above machines, covering a wide range of throats, capacities, types of jaw, equipment, etc.

Our line also includes: Upsetting, Forging and Rivet Machines, Eye Benders, Multiple Head Tapping Machines, Bending and Straightening Machines, Horizontal Punches, Hydraulic Presses, Power and Trimming Presses, Stay Bolt Breakers, Rotary Riveting Hammers, Angle Bending Rolls and Angle Shears.



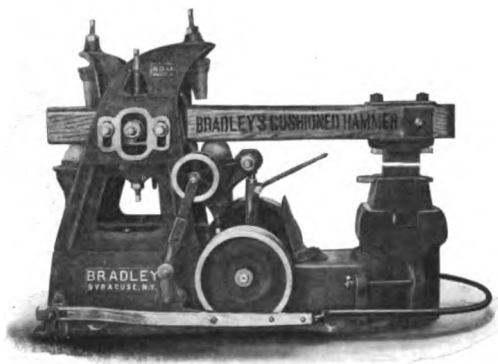
Multiple Punch

## C. C. BRADLEY & SON, INC.

SYRACUSE, N. Y.

Manufacturers of Bradley Cushioned Power Hammers, Forges

### THE BRADLEY Rubber Cushioned HELVE HAMMER



BRADLEY HAMMERS are made in Helve, Upright Strap, Upright Helve, and Compact styles, with heads ranging from 15 lbs. to 500 lbs., and capable of forging iron, steel and other metals from five inches square down.

If your work is continuous, like plating, drawing, swaging, collaring, welding or spindle work, with infrequent changes in size of material, or if it is die work where perfect accuracy and the finest finish are imperative, let the Bradley Helve Hammer be your choice. No other Hammer is like it. No other Hammer can equal it.

If your work is of a general, all-around jobbing character, with frequent variations in the size of stock, or is of such a nature that the Hammer is not worked continuously, but with frequent stops, a Bradley Upright Hammer may best answer the purpose.

If your work is such as described last above, and your floor space is limited, but with good height, and a somewhat less first cost is an object, we suggest the Bradley Compact Hammer.

DON'T GIVE THE FIRST COST of a Hammer too much prominence. The question of greater output, uninterrupted work, reduced cost for repairs and greater durability, are of more importance. Any excess in price of Bradley Hammers over others, is more than made up in the Hammers themselves.

*More Bradley Hammers are sold each year than of all other power Hammers combined. Separate circulars of each.*

#### WE MAKE

The Bradley Cushioned Helve Hammer	The Bradley Upright Helve Hammer
The Bradley Upright Strap Hammer	The Bradley Compact Hammer
Forges for Hard Coal or Coke	

# NAZEL ENGINEERING & MCH. WORKS

4041-4051 N. 5TH St., PHILADELPHIA, PA.

Manufacturers of Pneumatic Power Hammers For Belt or Direct Motor Drive

## THE NAZEL HAMMER

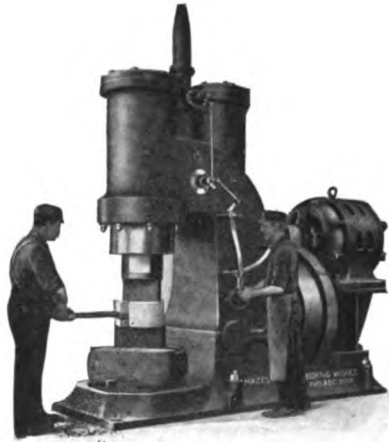
The special feature of The Nazel Hammer is, that it is self-contained, using the air at the temperature which it attains in compression and, as its expansion is almost perfect, it gives up nearly the full power that is put into it in compression.

This hammer is built in sizes from 75 lbs. to 850 lbs. This rating is purely arbitrary and is the same as used generally by hammer manufacturers, being the weight of the falling parts ram and die.

It is impossible to definitely rate hammers with respect to size of work, as so many factors enter into the problem, that any rate given for one would not apply to all; however in relation to ram weight these hammers have a far greater capacity than any other type, and while the capacities of hammers as specified are conservative, when making inquiries, the nature of the work, the largest as well as the average size and kind of material to be hammered should be given, to enable us to select the size hammer most suitable for the work.

### Its Features

Hammer & Compressor Combined.  
Simple Durable Construction.  
Powerful Clinging Blow.  
Positive Control.  
Variable Blows at Will without adjustments or change of speed.  
Holding Ram Suspended or Compressed.  
Long Ram Guide.  
Suitable Speed.  
Minimum Power with Highest Possible Efficiency.  
Belt Drive, No Countershaft.  
Motor Drive, Geared Direct.  
Power Consumed only when Running.



No. 6 Hammer Motor Driven

### SPECIFICATIONS

Sizes	1	2	3	4	5	6
Size of Material Worked Efficiently.....	2"x2"	4"x4"	5"x5"	7"x7"	8"x8"	9"x9"
Blows per Minute.....	220	210	180	150	130	120
Maximum horse power required.....	2.5	8.3	10.3	15	23.5	34.4
Requisite Motor (horse power).....	3	7.5	10	15	25	35
Desirable Motor Speed.....	1200	1100	1000	900	800	700
Stroke of Ram.....Inches	11	14	15½	19½	23½	27½
Center of Ram to Housing....."	10½	12½	13½	14½	16½	20½
Clear Working Space....."	8	10	14½	15½	17	22
Floor Space Required....."	67x28	75x30	87x33	94x37	110x43	118x47
Weight of Hammer Complete.....Pounds	4840	7050	10560	13640	20900	32000

Write for The Nazel Hammer Book. It's Interesting.

## ATLAS PRESS COMPANY

310 NO. PARK ST., KALAMAZOO, MICH., U. S. A.

Manufacturers of Atlas Compound Mandrel Presses

### EFFICIENT ARBOR PRESS EQUIPMENT

ATLAS PRESSES are built in all sizes and types for driving mandrels, bending and straightening, broaching, embossing with dies, setting bushings, etc. In fact all work requiring pressure up to 25 tons and centering capacity up to 38 inches may be done quicker and easier on our *Compound Presses* than by any other method.

Pinions are cut from forgings of Chrome Vanadium—Rams from specially treated Chrome Nickel. All parts designed to give highest degree of efficiency under all service conditions. *Complete details upon request.*

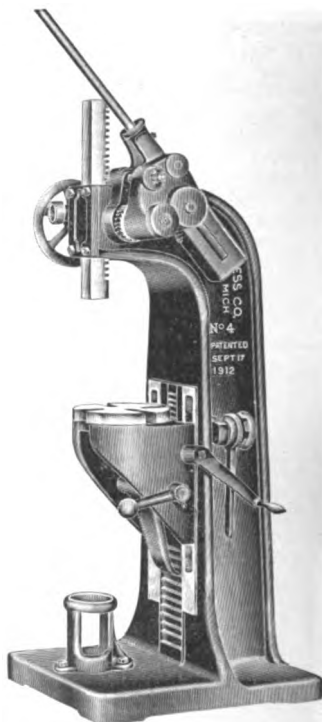
Carried in stock by leading machinery dealers everywhere.



No. 24 Press



No. 3 on Stand



No. 4 Press

# THE ACME MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

Code Word: ACME

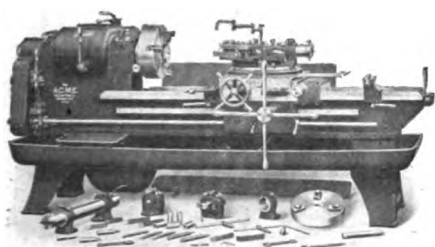
*Lieber's Code*

**Builders of Turret Machinery**

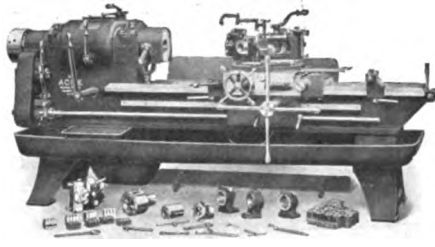
## CINCINNATI ACME

**FLAT TURRET LATHES, SCREW MACHINES, TURRET LATHES, BRASS WORKING MACHINES, UNIVERSAL TURRET LATHES, AND ALL TOOL ACCESSORIES**

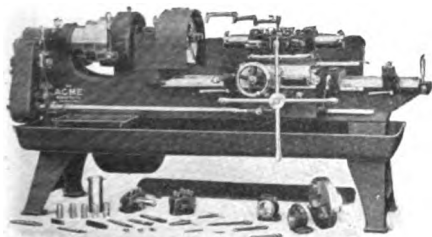
**FLAT TURRET LATHES**, the double purpose machines. Adapted to both bar and chucking work. Using simple, inexpensive tools. The greatest producers of work from bar stock, forgings and castings. Capacity bar stock  $2\frac{1}{4}$ " and  $3\frac{1}{4}$ " and chucking work 12" and 16" diameter.



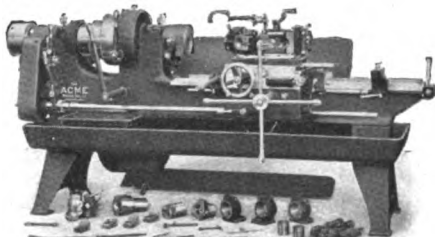
**$3\frac{1}{4}$ "x36" Flat Turret Lathe with Chucking Equipment**



**$3\frac{1}{4}$ "x36" Flat Turret Lathe with Bar Equipment**

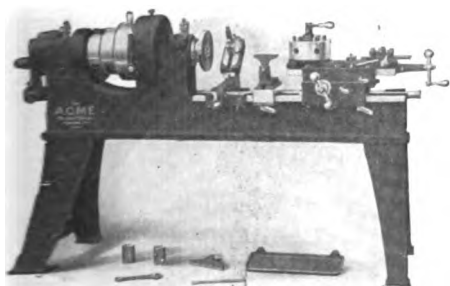


**$2\frac{1}{4}$ "x26" Flat Turret Lathe with Chucking Equipment**

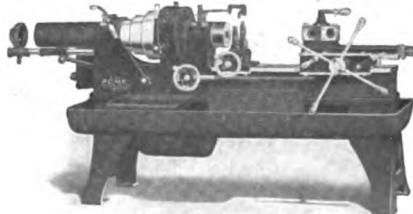


**$2\frac{1}{4}$ "x26" Flat Turret Lathe with Bar Equipment**

**TURRET LATHES AND BRASS WORKING MACHINES** made in four sizes. 14" to 20" swing. Plain or friction geared head, with or without automatic chuck, bar feed, automatic feed to turret, or cut off rest. Furnished with plain, set over or universal turret, also chasing attachment, forming attachment and all tools for rapid and accurate production.



**18" Universal Turret Lathe**



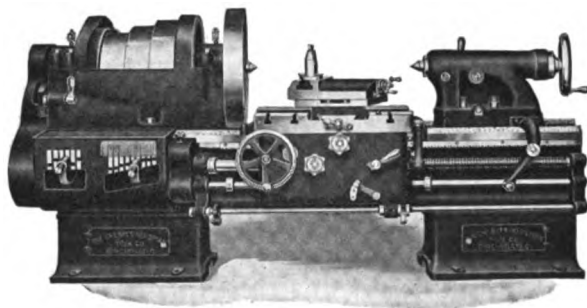
**$2\frac{1}{4}$ "x11" Screw Machine**

**SCREW MACHINES** made in five sizes. Automatic Chuck capacity  $\frac{3}{8}$ " to  $2\frac{1}{4}$ ", 11" to 20" swing. Plain or friction geared head with or without automatic feed to turret.

# THE GREAVES-KLUSMAN TOOL CO.

CINCINNATI, OHIO

Manufacturers of Engine Lathes



**20" Heavy Quick Change Three Step Cone Friction  
Double Back Gear Lathe**

## THE G-K WAY

The prime object in the design and construction of G-K Lathes is to give to their users a machine that will meet every requirement accurately, rapidly and give greatest convenience in operation.

This is accomplished by devoting our entire energy and equipment to the manufacturing of Engine Lathes. Our long experience in this line enables us to offer machines of the highest type and efficiency for the increasing demands of up-to-date shop practice.

We build a complete line of Engine Lathes, from 16" to 30" inclusive. Our 16" and 18" Lathes are built with three styles of Headstock:

Four Step Cone Single Back Gear.

Three Step Cone Friction Double Back Gear.

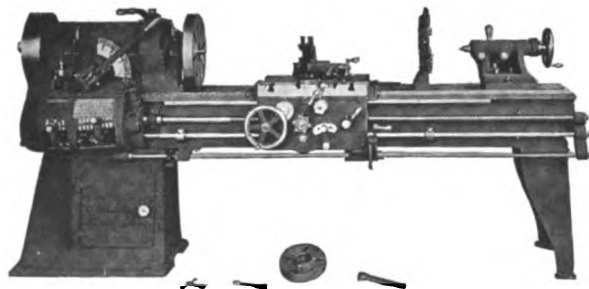
Geared Head, Single Pulley Drive.

Our 20", 24" and 30" Lathes are built in two styles:

Three Step Cone Friction Double Back Gear.

Geared Head, Single Pulley Drive.

All sizes of machines are built with Quick Change Mechanism.



**16" Heavy Quick Change Geared Head Lathe**

# **PITTSBURGH MACHINE TOOL CO.**

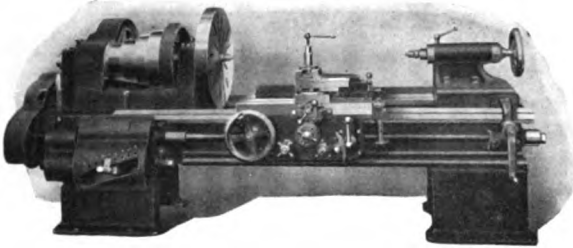
**BRADDOCK, PA.**

**Manufacturers of Heavy Engine Lathes**

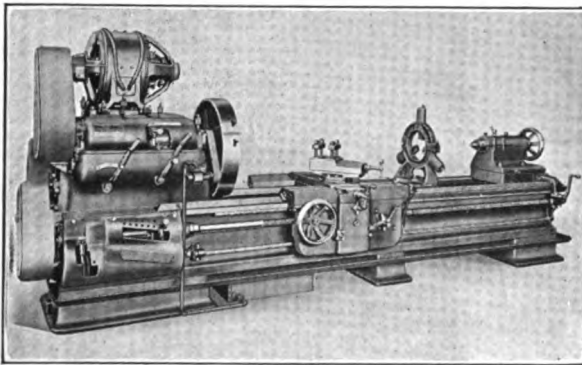
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## **PITTSBURGH ENGINE LATHES**

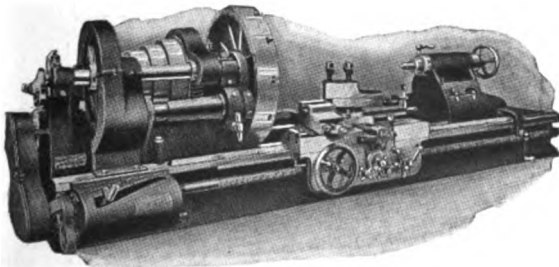
**Designed for heavy work. Built in 26", 28", 32", 38" and 42" sizes.**



**26" Double Back Geared Engine Lathe**



**32" All-Geared-Head Lathe**

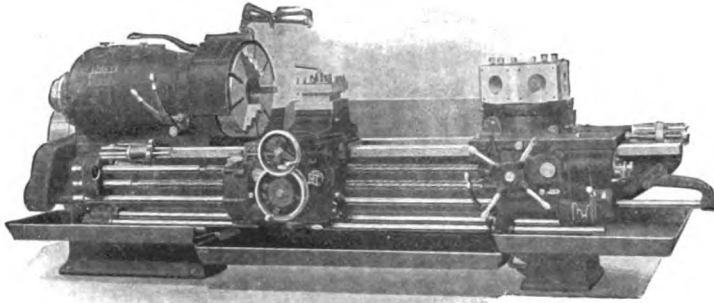


**42" Triple Geared Engine Lathe**

## INTERNATIONAL MACHINE TOOL COMPANY

1124 W. 21st St., INDIANAPOLIS, IND.

Manufacturers of The "Libby" Turret Lathes



### "LIBBY" TURRET LATHE

At present we are offering two sizes, our 16-18" type "A" machine with  $3\frac{9}{16}$ " hole through the spindle and our 24-26" type "C" machine with either  $4\frac{1}{2}$ " or  $7\frac{1}{2}$ " hole through the spindle. The type "A" machine will swing 16" over the tool post carriage and 18" over the ways; the type "C" machine will swing 24" over the tool post carriage and 26" over the ways.

#### Design is Right

In designing, building and offering the "LIBBY" Lathe we have had in mind the following prime factors:

A line of heavy duty turret lathes capable of forming, facing, turning and boring chucked pieces up to 26" in diameter and bar work up to  $7\frac{1}{4}$ " in diameter.

An all-gear head machine with a single pulley drive.

A machine with a side carriage, permitting the full swing of the work.

A machine with flat ways so located as to receive, as nearly as possible, all the cutting strains on the flat ways.

A machine with the best relative number of feeds and speeds for maximum quantity and quality production.

A machine with all feeds for each carriage independent one of the other.

A machine with convenient power rapid traverse for each carriage, independent one of the other and of the feeds.

A machine with abundant power for pulling heavy extensive cuts.

A machine with abundant rigidity and stiffness to easily carry heavy strains and produce accurate work continuously.

A machine so convenient to handle and easy on the operator that there would be every incentive to keep the machine under cut a maximum percentage of the time and thus give a maximum production.

#### We Claim for the "Libby" Lathe

That the limit of its production is the limit of the ability of the cutting tools to stand up.

That it is adapted to successful, rapid, continuous service under the most severe conditions.

That it is at its best in heavy work—several broad faced or other cutting tools working at one time.

That on account of its strength, rigidity and stiffness it will produce work free from chatter with smooth, accurate finish.

That the control of the machine is so concentrated and the convenience for operation so great that men like to operate a "LIBBY" Lathe and consequently push production with a minimum of fatigue.



# INTERNATIONAL MACHINE TOOL COMPANY

## CONDENSED DATA ON "LIBBY" LATHES

	16-18" "A" Lathe	24-26" "C" Lathe 4½" Hole	24-26" "C" Lathe 7½" Hole
Swing over ways.....	18½ in.	26½ in.	26½ in.
Swing over carriage.....	17¼ in.	24 in.	24 in.
Travel of turret carriage.....	44 in.	72 in.	72 in.
Travel of tool post carriage.....	40 in.	72 in.	72 in.
Greatest boring depth capacity..	13 in.	23 in.	23 in.
Hole in spindle.....	3⅝ in.	4½ in.	7½ in.
Three-jaw Universal chuck.....	16 in.	22 in.	22 in.
Front bronze bearing.....	4¾ in. x 7⅞ in.	6½ in. x 8⅞ in.	9½ in. x 8⅞ in.
Rear bronze bearings.....	4½ in. x 5¾ in.	5¾ in. x 5½ in.	8¾ in. x 5½ in.
Drive pulley—diameter.....	18 in.	18 in.	18 in.
Countershaft speed.....	480	500	360
Width of belt.....	4 in.	8 in.	8 in.
Horse power of motor.....	10	20	20
Speed of motor (constant).....	1200	1200	1200
Speed of motor (variable).....	750 to 1600	750 to 1600	750 to 1600
Size of motor pulley at 1200	4½ in. x 7¼ in.	8½ in. x 7½ in.	8½ in. x 5½ in.
R. P. M.....	diam.	diam.	diam.
Width of front way.....	5½ in.	6 in.	6 in.
Width of back way.....	3½ in.	4½ in.	4½ in.
Turret slide bearing on ways....	276 sq. in.	316 sq. in.	316 sq. in.
Tool post slide bearing on ways..	141 sq. in.	144 sq. in.	144 sq. in.
Diameter turret base.....	12¼ in.	16 in.	16 in.
Diameter of turret across flats...	14 in.	18 in.	18 in.
Hole in turret bushed to.....	3¼ in.	4¼ in.	4¼ in.
Center of turret holes over ways.	9 in.	12½ in.	12½ in.
Number of turret feeds.....	10	10	10
Range turret feeds.....	1/256 in. to ¼ in.	1/256 in. to ¼ in.	1/256 in. to ¼ in.
Diameter of tool post.....	7 in. sq.	9 in. sq.	9 in. sq.
Tool post feeds.....	6	6	6
Range of feeds.....	1/128 in. to ¼ in.	1/128 in. to ¼ in.	1/128 in. to ¼ in.
Power cross feeds.....	6	6	6
Range of cross feeds.....	1/128 in. to ¼ in.	1/128 in. to ¼ in.	1/128 in. to ¼ in.
Screw cutting change gears.....	7	7	7
Threads per inch.....	2 to 32	2 to 32	2 to 32
Number spindle speeds.....	8	8	8
Range spindle speeds.....	8 to 300	8 to 238	8 to 142
Gear ratios.....	1.87 to 1	2.1 to 1	2.53 to 1
	2.75 to 1	3.3 to 1	3.5 to 1
	5 to 1	5.6 to 1	6.7 to 1
	8 to 1	8.8 to 1	9.3 to 1
	13 to 1	14.9 to 1	12.2 to 1
	20 to 1	23.5 to 1	16.9 to 1
	38 to 1	40.1 to 1	32 to 1
Floor space.....	60 to 1	62.5 to 1	45 to 1
	60 in. x 138 in.	71 in. x 170 in.	71 in. x 170 in.
	33 in.	57 in.	57 in.
Radial sweep of bar.....	40 ft.	35 ft.	35 ft.
Rapid traverse per minute.....	7600	12000	13500
Net weight.....	8000	12600	14000
Shipping weight.....	9200	14000	15000
Shipping weight—export.....	250 cu. ft.	390 cu. ft.	390 cu. ft.
Space occupied—export.....			

## JONES & LAMSON MACHINE CO

SPRINGFIELD, VERMONT, U. S. A.

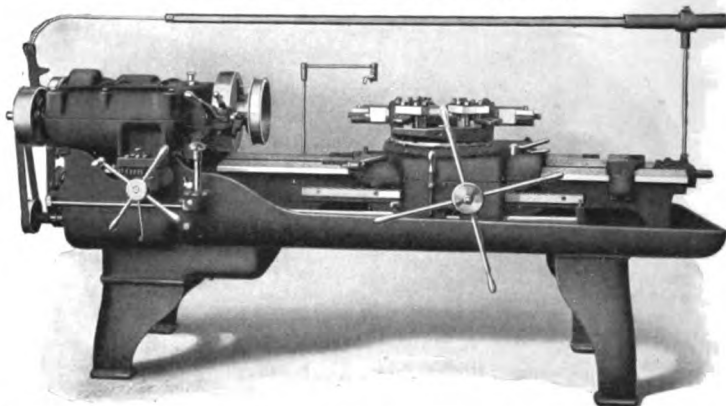
109 QUEEN VICTORIA STREET, LONDON, E. C.

France, Spain and Belgium: F. Auberty & Co., 91 Rue de Maubeuge, Paris.

Holland: Spliethoff, Beeuwkes & Co., Rotterdam.

**Manufacturers of Flat Turret and Automatic Lathes**

### HARTNESS FLAT TURRET LATHES



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The Hartness Flat Turret Lathe with cross-sliding head is made in two sizes, and may be furnished with an equipment of tools for either bar work or chuck work, or a double equipment for both bar and chuck work.

The smaller machine is called the 2 x 24-inch, and when equipped with the automatic die outfit of tools it turns nearly every conceivable shape from the bar, up to  $2\frac{1}{4}$  inches diameter and 24 inches of length. On chuck work its capacity is  $12\frac{1}{2}$  inches diameter or less.

The 3 x 36-inch size handles bars of stock up to 3 inches in diameter, turning pieces up to 36 inches in length. It may also be equipped for chuck work up to  $14\frac{1}{2}$  inches in diameter.

#### SPECIAL FEATURES

##### The Original Flat Turret

The Flat Turret was put on the market in 1891. Over ten thousand (10,000) machines equipped with them have been built and sold since, to the great satisfaction of the users. A large, steady tool clamping surface, a circular gib holding the turret down clear around its periphery, a locking pin directly under the cutting point of the tool—all these features combined to set a new standard of output, accuracy and range of work in turret lathe practice.

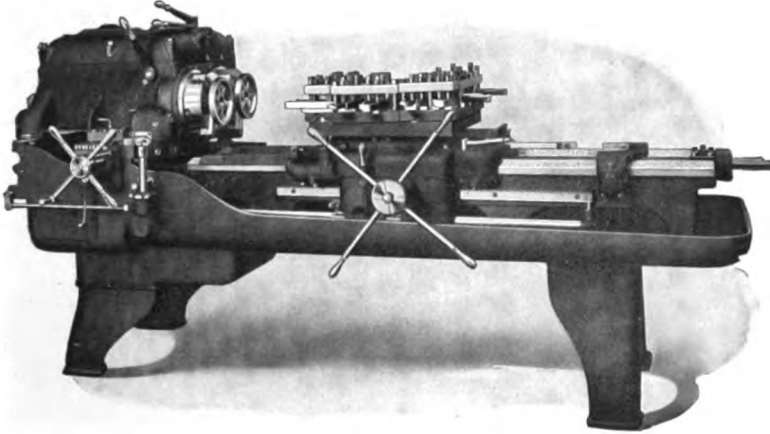
The unique set of tools employed covered at one leap the evolution from the old-fashioned "screw machine" to the modern turret lathe. It enabled the turret lathe to practically displace the engine lathe on bar and stud work.

##### The Cross-Sliding Head

This feature, introduced in 1903, still further extended the field of the turret lathe, making it the standard machine for most chuck work of moderate size. The Cross-Sliding Head has three advantages: (1) It offers a cross-sliding motion gibbed directly and securely to the bed. There is no piling of slide on slide, no narrow bearing foundation for a lofty superstructure of slide, tool holder and tool. (2) It permits the cross feed to be applied to every tool on the turret if necessary. (3) By allowing a cross adjustment to every tool, complicated and costly special tools are minimized. The regular outfit covers all regular work. The design is so stable that the piloted type of holder is seldom needed.

# JONES & LAMSON MACHINE CO.

## THE DOUBLE SPINDLE HARTNESS FLAT TURRET LATHE



The special field of usefulness of the "Double-Spindle" Hartness Flat Turret Lathe is in machining moderate sized castings, forgings, and certain limited classes of bar work in large lots for quantity of production. In addition it may be used as a single-spindle machine of larger capacity, in which case it is adapted to small lot manufacture.

The machine has all the good qualities of the Single-Spindle Flat Turret Lathe which we introduced nearly a quarter century ago. With the expiration of the original patents, the flat turret has been adopted by other makers as the standard design for manufacturing work. But our later developments, like the cross-sliding head and the essential features of the double spindle, are of great mechanical and economic value to the manufacturer and are found exclusively in these machines.

The double-spindle feature nearly doubles the output per operator and per machine.

Two spindles, two sets of tools, two pieces of work.

One turret, one machine, one operator, one set of motions.

### SPECIFICATIONS

**Working Range.** Swing over ways is 17 inches when used as a single-spindle machine, 10½ inches when both spindles are used. Cross travel of head is 10½ inches. Hole through spindle is 3¼ inches.

**The Cross-Sliding Head.** This is the only turret lathe in which the work-carrying headstock has a cross travel. This is indispensable on chuck work and is frequently convenient on bar work. It gives a cross feed for every tool without resorting to the frail double slide under the turret. Nine speeds in both directions from 20 to 298 revolutions per minute instantly obtainable. All gears run in oil bath.

**The Turret.** This is the original flat turret, 22 inches square, and is gibbed near outer edge. Index pin is located directly under working tool. On single-spindle work the corners of the turret can be used, giving eight positions in all.

**The Power Feed.** Both the carriage and the cross-sliding headstock are provided with power feed. It operates in both directions; has nine changes from 20 to 120 revolutions per inch of travel. These changes are instantly obtainable by sliding gears.

**Stops.** Each of the eight positions of turret is equipped with a separate stop, and there are four extra stops, making twelve in all. If desired, six stops can be used for one tool. The cross travel of the head is controlled by nine stops. Both sets of stops act in both directions and are placed as near as possible to the direct line of stress.

**Floor Space for Machine** is 5 x 10 feet. Approximate weight: net, 6600 pounds; crated, 6700 pounds; boxed for export, 7200 pounds. Cubic measurement, 240 cubic feet.



(Continued on next page)

(Continued from preceding pages)

## JONES & LAMSON MACHINE CO.

SPRINGFIELD, VERMONT, U. S. A.

### THE FAY AUTOMATIC LATHE

The Fay Automatic Lathe is a real lathe, with headstock, tailstock, carriage and bed. It differs from the engine lathe in the details of its mechanism, which fit it especially for the particular work it is designed to do. There is also the added mechanism required to make it automatic in all its motions.

**Field:** The Fay Lathe is designed for the automatic turning of work held on centers. It is thus adapted to work which is itself centered, or to work which is mounted on an arbor.

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In the class of *centered work* are included such standard parts as steering knuckles for automobiles, driving gears for transmission, forgings in general of such shape as to be turned rather than chucked, and many miscellaneous castings of the same type.

In the class of *work done on arbors* is included the large variety of parts which in ordinary practice is turned in the engine lathe by this means, as pulleys (either straight-faced or crowned), gear blanks, flanges, disks, hubs, and a thousand and one other pieces of the kind used in textile machinery, automobiles, machine tools, electrical work and machine building in general.

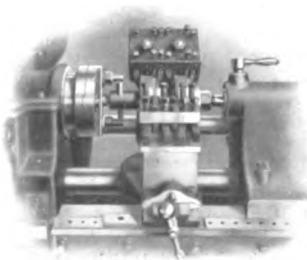
*Second operation work* is the legitimate field of the Fay Lathe.

Furthermore, it has a large field of usefulness in the accurate finishing of parts roughed out on other and less accurate automatic machines.

On the work described above the Fay Lathe will do straight turning, taper turning, form turning, straight facing, bevel facing, recessing, singly or in combination, with roughing or finishing cuts. It will do everything of this sort except threading, for which it is not adapted.

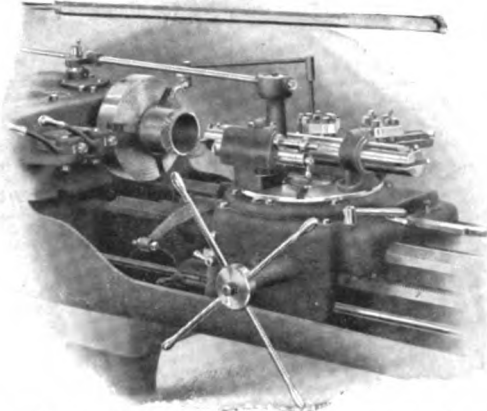
#### Advantages of the Fay Automatic

1. Ease of setting.
2. Rapidity of changing work.
3. Two pieces at a time.
4. Multiple tooling.
5. Taper turning and bevel facing.
6. Form turning.
7. Turned surfaces free from scoring on the return movement.
8. Flexibility of mechanism.
9. Facing and turning simultaneously.
10. One operator runs two machines.



Profitable Work for the Automatic Lathe

# JONES & LAMSON MACHINE CO.



## AUTOMATIC CHASING ATTACHMENT

The Hartness Chasing Attachment is shown applied to the Flat Turret Lathe.

This attachment is automatic. The carriage is locked to the bed and the attachment clutched with its positive drive from the work spindle. The threading tool feeds forward at cutting depth under lead screw control until the tool bar strikes a stop. The tool is then withdrawn to clear the work and re-

turned at high speed to the starting point, where it is again fed in to cutting depth and engaged with the lead screw. The work spindle revolves continuously. The only motion required of the operator is that of adjusting the cross sliding head forward a slight amount during the return of the cutter to feed the tool in for the new cut. There is no possibility of overrunning and gouging into a shoulder, no matter how fast the machine is run.

The advantage of this attachment is that it gives engine lathe accuracy to turret lathe threading—and it gives much more than engine lathe speed.

## HARTNESS AUTOMATIC DIE

**Wide Range      Few Dies      High Accuracy      Small Expense**

**No. 1 Die:** Range for standard threads, from  $\frac{1}{8}$  inch to  $\frac{1}{4}$  inch diameter, any length. Particularly adapted for small hand or automatic screw machine work.

**No. 4 Die:** Range,  $\frac{1}{4}$  inch to  $1\frac{1}{4}$  inches diameter. This die is suitable for general turret lathe and screw machine use. It is especially adapted for use in automatic screw machines, owing to the compactness of its design.

**No. 6 Die:** Range,  $\frac{3}{4}$  inch to 2 inches diameter. This die is adapted for medium to large work on screw machines and turret lathes, and for the larger sizes of automatic screw machines.

**No. 9 Die:** Range,  $1\frac{1}{4}$  inches to 3 inches diameter.

This die is designed for the heaviest turret lathe work. It is provided with six chasers, and has a special double roughing attachment which adapts it particularly to large diameters or coarse pitches.

Any of these dies, even the large No. 9, will thread pitches as fine as 32 per inch on its largest diameter without danger of stripping.

The lead-controlling feature is exclusive with this die. You can cut long threads as accurate in pitch as you will get from the ordinary engine lathe.



The No. 4 Hartness Automatic Die and Its Parts

# THE WARNER & SWASEY COMPANY

CLEVELAND, OHIO

NEW YORK

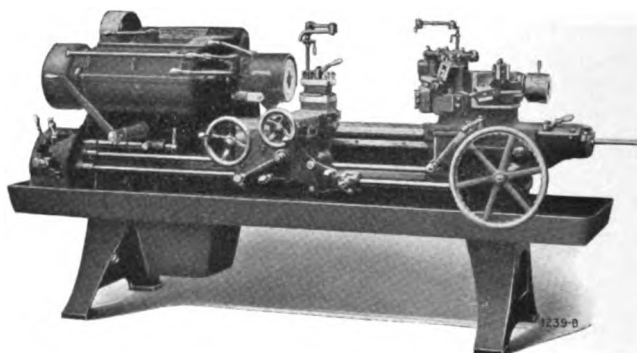
BOSTON

BUFFALO

DETROIT

CHICAGO

Manufacturers of Turret Machinery

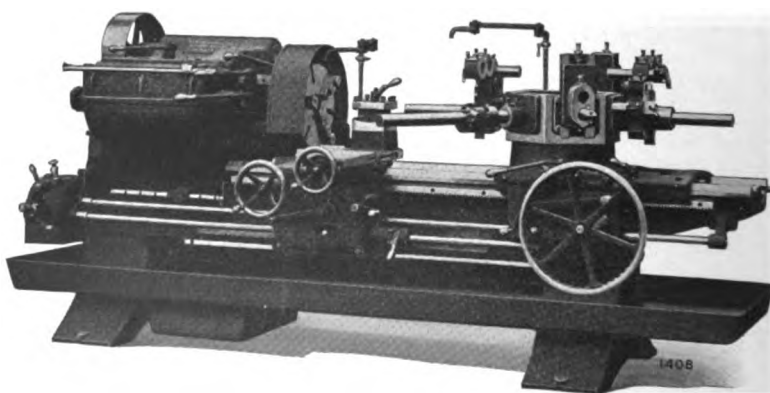


No. 2-A Universal Hollow-Hexagon Turret Lathe: Bar Equipment  
Two Capacities— $2\frac{1}{2}$ " x 29";  $16\frac{1}{2}$ " swing  
 $3\frac{3}{4}$ " x 29";  $16\frac{1}{2}$ " swing

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## UNIVERSAL HOLLOW-HEXAGON TURRET LATHES

These machines take two cuts at one time. By means of separate feed shafts for carriage and turret saddle, each with ten individual feeds in either direction, the carriage will face, neck or form while the turret is drilling, reaming or turning. Each machine is equally adaptable to bar or chucking work.



No. 3-A Universal Hollow-Hexagon Turret Lathe: Chucking Equipment  
Two Capacities— $3\frac{1}{2}$ " x 40";  $21\frac{1}{2}$ " swing  
 $4\frac{1}{2}$ " x 40";  $21\frac{1}{2}$ " swing

# THE WARNER & SWASEY COMPANY

CLEVELAND, OHIO

NEW YORK

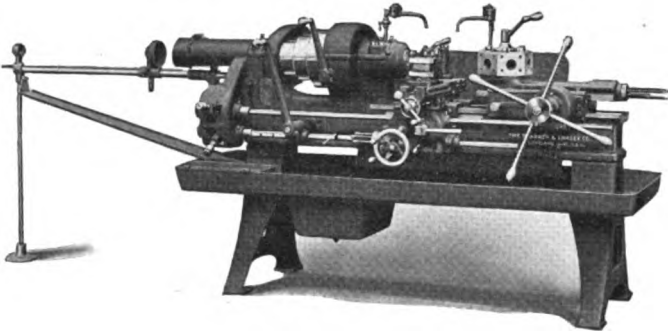
BOSTON

BUFFALO

DETROIT

CHICAGO

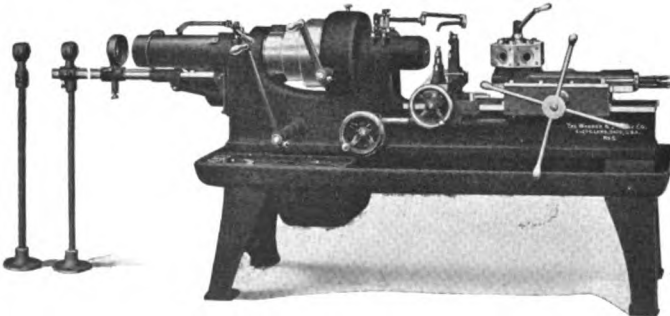
**Manufacturers of Turret Machinery**



**No. 4 Universal Turret Screw Machine: Bar Equipment**  
Capacity:  $1\frac{1}{2}$ " x 10"; 16" swing

## TURRET SCREW MACHINES

Included in the five sizes is the No. 4 Universal, shown above, which takes two cuts at one time. Individual power-operated feed shafts for carriage and turret saddle provide for simultaneous operation at the exact feed suited to each diameter, as with the Universal Hollow-Hexagon Turret Lathes.



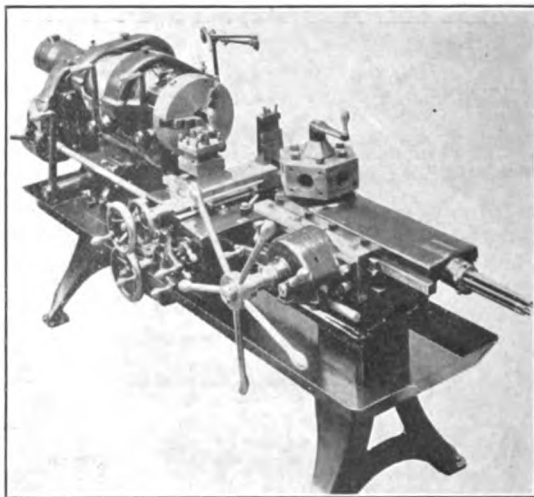
**No. 6 Turret Screw Machine: Geared Friction Head**  
Capacity:  $2\frac{1}{4}$ " x 10"; 18" swing  
Other Turret Screw Machines from  $\frac{1}{8}$ " capacity



## **W. K. MILLHOLLAND MACHINE CO.**

INDIANAPOLIS, INDIANA

**Builders of "Millholland" Screw Machines and Turret Lathes**



**No. 4 Universal Turret Screw Machine**

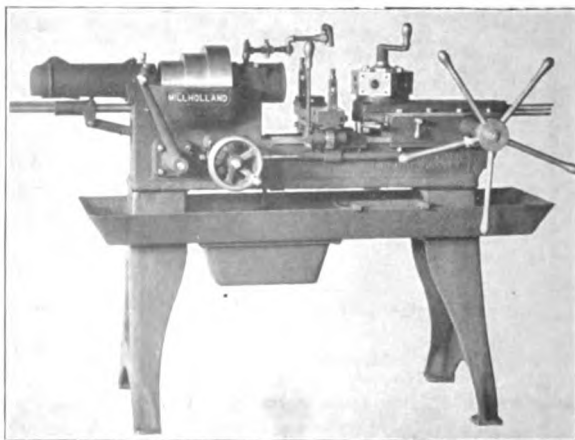
### **TURRET SCREW MACHINES**

Sizes 1 x 7, 1½ x 10, and 2¼ x 10 capacity.

### **MILLHOLLAND MANUFACTURING TURRET LATHES**

Sizes 2½ x 30 and 3¼ x 30. Chucking capacity 18". Designed for broad facing cuts, all tools fed by screw. Bar and chucking equipments are readily interchangeable.

*Catalog fully describing machines sent upon request.*



**No. 2 Screw Machine, 1 x 7 Capacity**

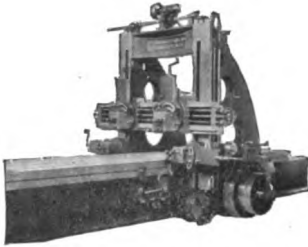


## THE CINCINNATI PLANER CO.

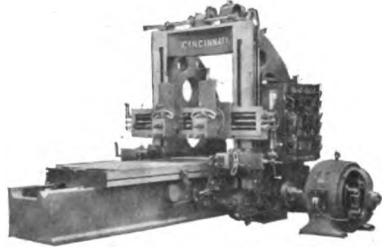
OAKLEY, CINCINNATI, OHIO

Manufacturers of Planers and Boring Mills

**CINCINNATI PLANERS** are designed for strength, rigidity, durability, convenience in operation and adaptability for all classes of work required of a planer.



Standard Planer



Reversible Motor Driven Planer

**Standard Planers** are made in all sizes from 22" to 96". *The beds* are of a heavy deep box section and are especially strengthened where the gearing and uprights are mounted. *The tables* are of unusual thickness and are braced at short intervals with heavy ribs, thus preventing any possibility of springing under any circumstances. *Cross rails* are of great depth, and have an extra deep box brace on the back. *The heads* are distinctive, the ends of tool blocks and slides being made round. *The gearing and rack* are of extra wide face—all the large gears and racks being made from semi-steel castings and the pinions from steel forgings.

**Widened Planers:** There is a great variety of planing which does not require a standard machine and in many cases a widened planer will do the work better, as it is easier to handle and capable of higher speeds. We build these planers to suit your work, and have patterns for the various sizes given.

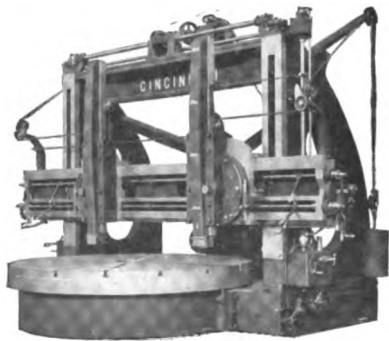
SIZES—36" x 30", 42" x 36", 48" x 36", 56" x 42", 60" x 48", 72" x 56", 96" x 72".

**Variable Speed Planers:** The greatest possible gain in planing comes from access to a change of cutting speeds. A correct speed for all materials and conditions, instantly available, is the secret of economy in planing. Our variable speed planers are arranged for ten cutting speeds and ten return speeds.

**Motor Driven Planers:** All Cincinnati Planers may be arranged for motor drive.

**CINCINNATI BORING MILLS** are made in sizes 5', 6', 7', 8', 10', 12', 14' and 16'.

**General Description:** *The bed* is of deep box form throughout. All parts are thoroughly ribbed and braced and the entire mechanism of the mill is supported on the bed. *The table* is large in diameter and supported on a broad, flat annular bearing of large diameter. *The main driving gear* is an internal gear cut from the solid. *The housings* are of massive box form, a wide and long base insuring rigidity under the most severe duty. *The cross rail* is of box form and has a deep arch on the back so that any deflection due to weight of heads or pressure of the cut is reduced to a minimum. *The heads* have the narrow guide bearing at bottom of rail, which prevents all tilting or binding while heads are under cutting strain. *Eight different feeds* are provided ranging from 1-32" to 1".



Standard Boring Mill

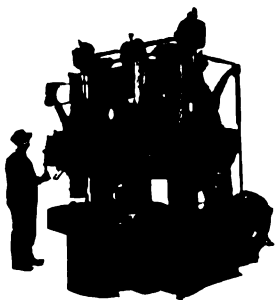
## NILES-BEMENT-POND COMPANY

GENERAL OFFICES: 111 BROADWAY, NEW YORK

### OFFICES AND AGENCIES

BOSTON PHILADELPHIA BIRMINGHAM PITTSBURGH CINCINNATI CLEVELAND  
DETROIT CHICAGO ST. LOUIS SAN FRANCISCO LONDON

Manufacturers of Steam Hammers, Electric Traveling Cranes and Complete Machine Tool Equipments for General Machine Shops, Railroad Shop, Ship and Navy Yards and Heavy Ordnance or Small Arms Arsenals



### MACHINE TOOLS

We build a very complete line of machine tools, including lathes, planers, boring mills, slotters, drilling machines, milling machines, shapers, boring and drilling machines, boring, drilling and milling machines, locomotive, car and axle machines, etc.



### STEAM HAMMERS

Bement Steam Hammers are built in single-frame, double-frame and drop-hammer types. They are entirely dependable and are so designed that with very little attention they can be operated continuously without breakdowns. In their construction only the best material and workmanship are used.



### TRAVELING CRANES

We build various types of Electric Traveling Cranes, trolleys and hoists. They are designed to obtain the highest operating efficiency with the lowest cost of maintenance. We are at all times ready to aid you in the solution of your handling problems.

### PRATT & WHITNEY PRECISION MACHINE TOOLS

Pratt & Whitney Precision Machine Tools include bench lathes, engine lathes, turret lathes, hand screw machines, hand, automatic, thread and spline milling machines, die sinking machines, profiling machines, surface grinding machines, vertical shapers, etc. Also rifling and deep hole drilling machines and other small arms arsenal machinery.

### P. & W. MACHINISTS' SMALL TOOLS

include taps, dies, reamers, milling cutters, drills, etc., etc.

### P. & W. STANDARDS AND GAUGES

*Catalogs, Circulars and Full Information upon Request.*

# T. C. DILL MACHINE COMPANY, INC.

PHILADELPHIA, PA., U. S. A.

Builders of Slotters

## THE "DILL SLOTTER"

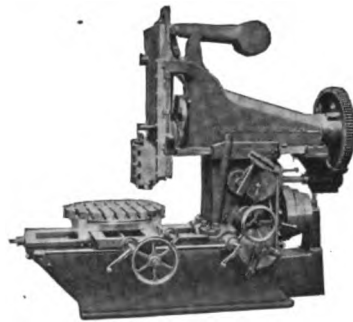
In the design of the "Dill Slotter," to meet the demands of today, it was plain that a departure was necessary and that procedure must be in at least two directions: First, that the machine must be able to produce a greater amount of work and that work must be more accurate. Second, that it must have a much greater range and not be confined only to the ordinary slotter work, but also reach out into other fields of usefulness; and, besides all this, it must be, if possible, more durable. The following features, which for the most part are exclusive, show how this Slotter meets the above requirements.

The GENERAL CONSTRUCTION of the "Dill Slotter" throughout is such as to insure efficiency and durability. It is constructed of the best material for the purpose; the gears are all cut from solid metal and mostly of forged steel; flat bearing surfaces are all hand-scraped to surface plates and are of ample dimensions. Gears, shafts, etc., are readily accessible for inspection. The convenience of operation is of special merit; while it is operative from one point principally, hand feeds are provided on all sides.

### Attributes

- A Traveling Head**—Greatly increases the range of the machine.
- A Quick Traverse Gear**—A great time and labor saver.
- New Quick Return**—Permits high and uniform cutting speeds.
- New Intermittent Feed**—For feeding heavy work at high speeds.
- An Automatic Knock-Off**—A safety device for the feed mechanism.
- A Stroke Indicator**—Quite indispensable; nothing like it.
- A Hand Wheel Controller**—A good thing, and in the right place.
- A Tool Post in the Relief Apron**—Very handy in changing tools.
- Six Changes of Speed**—About four is the usual number.
- Belt and Motor Driven**—Designed for both; not a make-shift.
- Powerfully Geared**—About double the usual ratio.

15 Inch Slotter. Belt or Motor Driven



Arranged for Belt Drive

### PRINCIPAL DIMENSIONS

Size of machine, in.....	10	10-12	15	15-18	20	20-24
Maximum stroke, in.....	10½	12½	15½	18½	21	25
Longitudinal movement of table, in.....	28	28	36	36	48	48
Transverse movement of table, in.....	20	20	30	30	40	40
Diameter of table, in.....	24	24	34	34	44	44
Movement of head, in.....	15	15	20	20	30	30
From table to head, in.....	12	12	19¼	19¼	24½	24½
Adjustment of ram, in.....	16	16	23	23	32	32
Will cut to the center of circle of.....	54 in.	54 in.	72 in.	72 in.	92 in.	92 in.
Will cut to outside of circle of.....	54 in.	54 in.	90 in.	90 in.	108 in.	108 in.
Strokes of ram per minute, r. p. m.....	11½-85	10-76	8-48	7-43	6-31	5½-27
Feed of table per stroke, in.....	0.011	0.011	0.010	0.010	0.0069	0.0069
Circular feed per stroke at 12 in. dia. (in.)	to 0.154	to 0.154	to 0.187	to 0.187	to 0.138	to 0.138
Feed of head per stroke, in.....	0.0187	0.0187	0.011	0.011	0.0055	0.0055
Ratio of gears from cone pulley shaft.....	to 0.261	to 0.261	to 0.196	to 0.196	to 0.11	to 0.11
Size of countershaft pulley, in.....	0.0055	0.0055	0.005	0.005	0.00345	0.00345
Speed of countershaft, r. p. m.....	to 0.077	to 0.077	to 0.093	to 0.093	to 0.069	to 0.069
Horsepower of motor.....	12 to 1	12 to 1	18 to 1	18 to 1	24 to 1	24 to 1
Speed of constant speed motor, r. p. m.....	14 x 3½	14 x 3½	20 x 4	20 x 4	26 x 5	26 x 5
Speed of variable speed motor, r. p. m.....	200	180	200	180	200	180
Net weight, lbs.....	3	3	5	5	10	10
Code word.....	1,200	1,000	1,200	1,000	1,200	1,000
	400 to	400 to	400 to	400 to	400 to	400 to
	1,200	1,200	1,200	1,200	1,200	1,200
	5,750	6,000	11,000	11,500	25,000	26,000
	Ummoj	Ummuk	Ummyl	Umnag	Umnch	Umnig

## THE NATIONAL ACME COMPANY

CLEVELAND, OHIO, U. S. A.

NEW YORK

BOSTON

CHICAGO

DETROIT

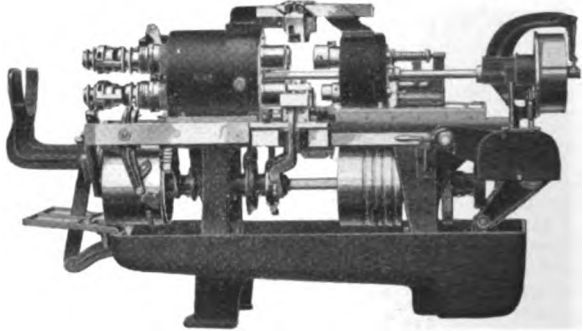
**Screw Machinery, Dies and Screw Machine Products**

### ACME MULTIPLE SPINDLE AUTOMATIC SCREW MACHINES

#### Capacity

The Acme Automatic handles any screw-cutting work up to  $3\frac{3}{4}$ " diameter and 12" long in the time of one operation.

Furnished with either Single Belt or Motor Drive.



**ACME AUTOMATIC MULTIPLE SPINDLE SCREW MACHINES** are rapid producers of screws and parts from bars of Brass, Iron and Steel.

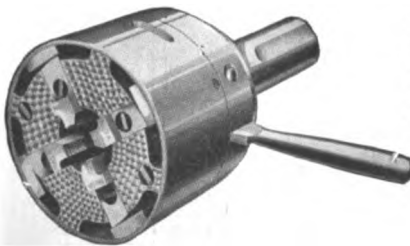
They carry four bars of stock upon which as many as eight tools can be worked at one time.

In addition to the usual tool equipment, tools for shaving, cross drilling, end and side milling, etc., can be employed without increasing the cutting time—one operation.

**AUXILIARY SCREW-MAKING MACHINES** of fully automatic and semi-automatic types are also built as follows: Stud Threaders, Bolt Threaders, Single and Multiple Spindle Drilling Machines for screw heads and special drilling operations, Screw Head Slotting Machines; also Die Chaser and Tool Grinder.

These machines are highly specialized for work that can be most economically done after the parts leave the screw machine. Catalog covering complete line on request.

### NAMCO AUTOMATIC THREADING DIES



for every threading requirement include: Self-Opening Dies for Hand Machines; Self-Opening-Self-Closing Die Heads for Automatic Screw Machines, Bolt Threaders, etc. Adjustable Chaser Dies for heavy duty work; Adjustable Spring Dies and Collet Holders. Catalog?

# THE NATIONAL ACME COMPANY

(Successors to Windsor Machine Co.)

WINDSOR, VERMONT

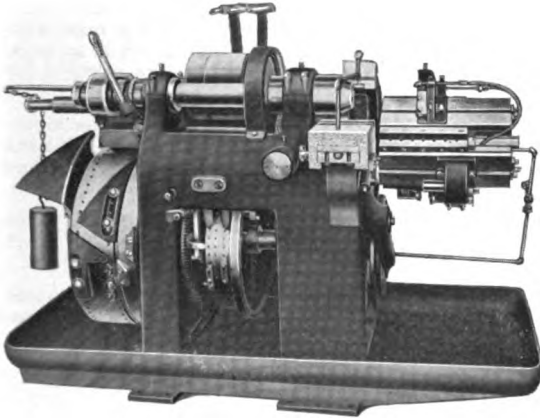
NEW YORK

BOSTON

CHICAGO

DETROIT

## GRIDLEY MULTIPLE AND SINGLE SPINDLE AUTOMATIC SCREW MACHINES



### The Single Spindle Gridley

is built in four sizes— $2\frac{1}{4}$ "— $3\frac{1}{4}$ "— $4\frac{1}{4}$ "—5", and handles work up to 12" in length.

**GRIDLEY SINGLE AND MULTIPLE SPINDLE SCREW MACHINES** are designed for making parts from bar stock up to 5" diameter.

They are fully automatic and the tools are held rigidly, close up to their cutting point.

The simplicity of the set-up allows for an exceptionally wide range of tooling.

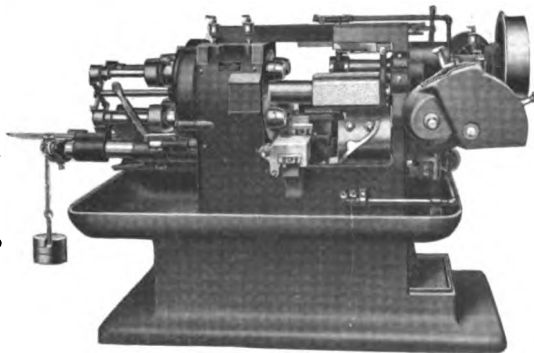
Many combinations of tools can be made on each slide, thereby doubling or trebling the work at one movement of the turret.

The tool slide on the Multiple Machine is mounted upon an extension of the spindle carrier which insures correct alignment of tools with spindles at all times.

Both Single and Multiple Spindle Gridley Automatics are furnished in Belt or Motor Drive. 94 page catalog free.

### The Four Spindle Gridley

is built in four sizes— $\frac{3}{4}$ "— $1\frac{1}{4}$ "— $1\frac{3}{4}$ "— $2\frac{1}{4}$ ", and handles work up to 7" in length.



## THE FELLOWS GEAR SHAPER CO.

SPRINGFIELD, VERMONT, U. S. A.

Sole Makers of Gear Shapers and Gear Shaper Cutters

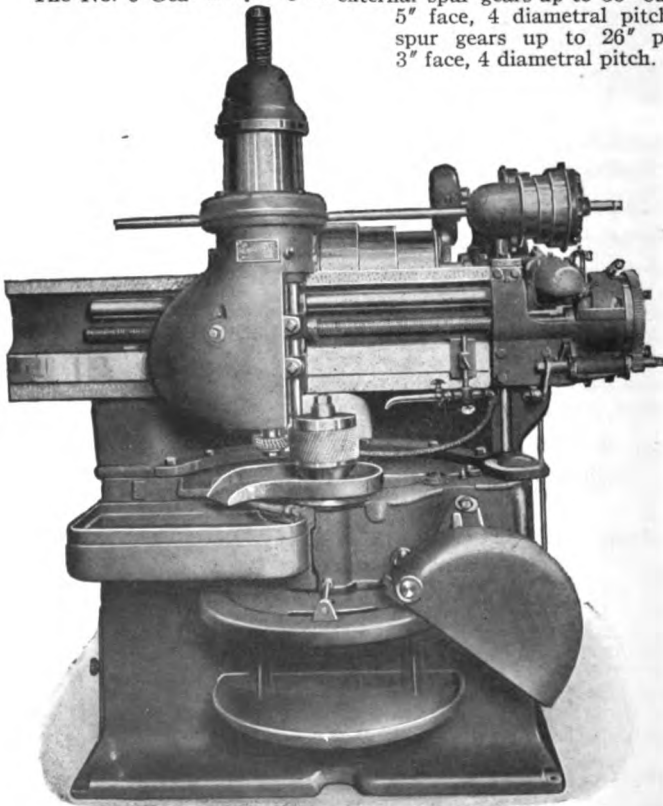
### THE HELICAL GEAR SHAPER

This machine is designed to cut the teeth in helical gears by the generating process. The cutter is ground after hardening to the correct involute form. The Fellows Helical Gear Shaper is designed for producing accurate quiet running gears in large quantities. That it meets these requirements is attested by the fact that the manufacturers of high-grade automobiles are using it for cutting timer gears.

It works on exactly the same principle as the spur machine and the movement of the cutter is controlled by means of helical guides, right- and left-hand guides being supplied with the machine. The cutters are in pairs, right- and left-hand, the helix angle corresponding accurately to that of the gears being cut.

The No. 65 Helical Gear Shaper cuts external helical gears up to 26" pitch diameter, 5" face,  $\frac{3}{7}$  diametral pitch; internal helical gears up to 26" pitch diameter, 3" face,  $\frac{3}{7}$  diametral pitch.

The No. 6 Gear Shaper cuts external spur gears up to 35" outside diameter, 5" face, 4 diametral pitch, and internal spur gears up to 26" pitch diameter, 3" face, 4 diametral pitch.



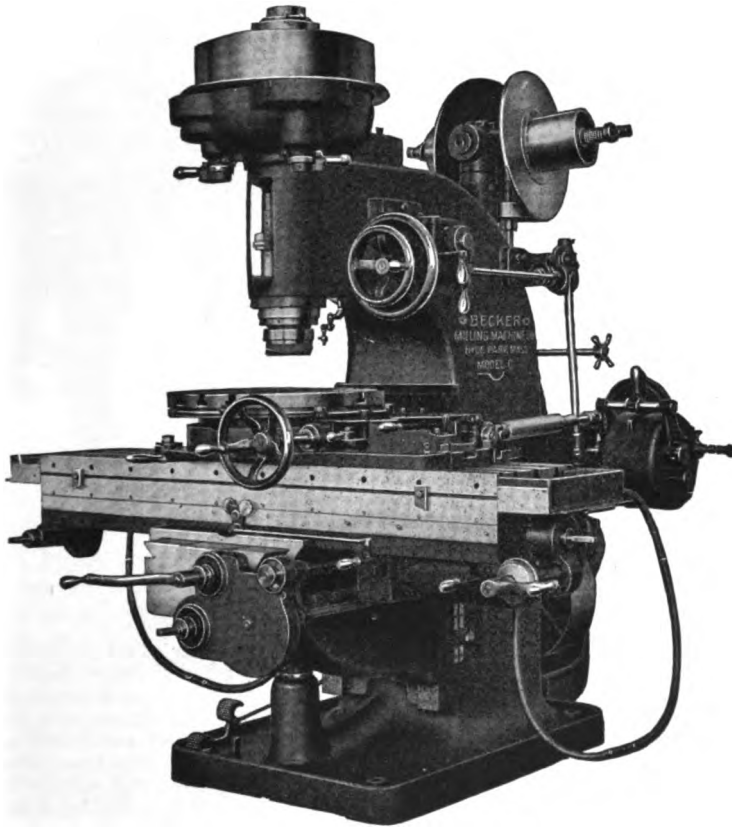
No. 65  
Fellows  
Helical  
Gear  
Shaper



## BECKER MILLING MACHINE CO.

FACTORY AND OFFICES AT  
HYDE PARK, BOSTON, MASS.

Milling, Routing and Die Sinking Machines, Milling Cutters



**Model C High Power Vertical Miller**

277

### **MILLING MACHINES**

Vertical  
Continuous  
Horizontal  
Plain  
Universal  
and  
Lincoln

### **MILLING CUTTERS**

Inserted Tooth  
Plain  
Side  
Angle  
End Mills  
Metal Slitting Saws  
Carbon and Hi-speed

# THE BILTON MACHINE TOOL CO.

BRIDGEPORT, CONN., U. S. A.

**Manufacturers of Automatic Gear Milling Machines, Gear Hobbing Machines, Automatic Milling Machines, Automatic Slitting Machines for Knitting Machine Trade, Plain and Ball Bearing Sensitive Drill Presses, Plain Milling Machines, Riveting Machines**

## AUTOMATIC GEAR MILLING MACHINES

Made in 3 sizes for spur or bevel gears.

No 1	1½	4" dia.	14 pitch
No. 2	2½	6" dia.	10 pitch
No. 3½		8" dia.	8 pitch

These machines can be adapted to a large variety of special form milling which can only be done to advantage on these machines. Used on milling cutters, reamers, taps, cylinders also small worms with attachment.

*Our catalogue No. 15 shows what can be accomplished*

### SPECIAL FEATURES

- Entirely automatic action.
- Positive and direct indexing to the work.
- Cutter clears work while indexing.
- Quick releasing fixture for removing work.
- Large production through quick action of machine.
- Exceptional wide range of usefulness.

The above sizes are also made in vertical type, used for milling and slotting sinker rings, dials, plates, milling cutters. Range up to 18" dia.



## UNIVERSAL GEAR HOBGING MACHINES

Capacity: 10" dia.  
10 pitch  
10" width of face  
weight 2100 lbs.

Will automatically hob spur spiral gears, worms and worm gears, also variety of special shapes.

Base and oil pan extra heavy with liberal reinforcements to absorb vibration. Work table driven by large bronze worm gear and worm and automatically lubricated. Machine uses least possible number of feed and index gears. Hob spindle bored for No. 9 B & S Taper, driven by Helical gear 8-10 pitch. Machine entirely of latest design with new feature to increase production without sacrificing accuracy.

Send for catalogue.

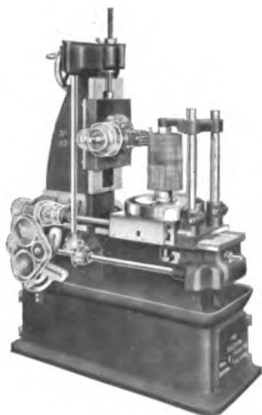
Plain Horizontal Knee and Column Type Milling Machines, 27"x8"x18", weight 1800 lbs.

High Speed Ball Bearing Drill Press, ¾" capacity, weight 500 lbs.

Automatic Cam Feed Drill Press, ½" capacity, 4 and 6 spindle.

MILL-IT-AUTOMATIC Machines for automatic milling.

FOREIGN AGENTS: Chas. Churchill Co., Alfred Herbert, M. Mett. Eng. Co.



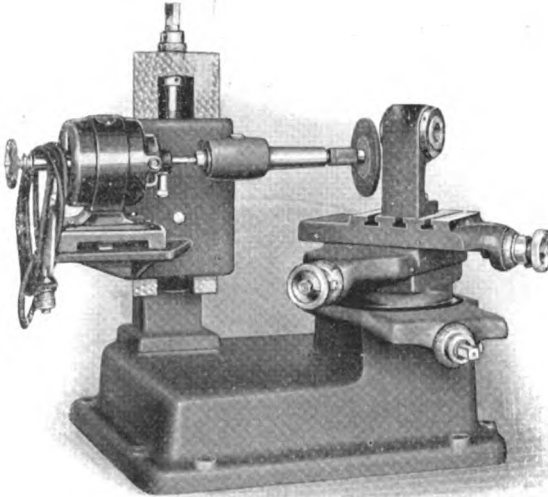


# THE CLEVELAND MILLING MACHINE CO.

18511 EUCLID AVE., CLEVELAND, O.

Manufacturers of Milling Cutters, Milling Machines, Special Tools

## CLEVELAND PROFILE TOOL GRINDER



279

A Profile Tool Grinder that makes possible profile or milled teeth instead of formed teeth on convex and concave cutters, cutters for fluting drills, cutters that are irregular in shape but having a number of true curves; advantages being that the milled toothed cutter is cheaper to make, more accurate and in most cases more efficient, inasmuch as the correct clearance angle is ground on top of tooth.

In addition, the machine is peculiarly adapted to grinding perfect curves on the corners of Side Mills and Face Mills instead of the usual method of breaking the corners on an ordinary tool grinder. This obviously prolongs the life of the cutter as well as increases its efficiency both with respect to finish and increased production.



Showing Variety of Cutters Which Can  
Be Ground on This Machine

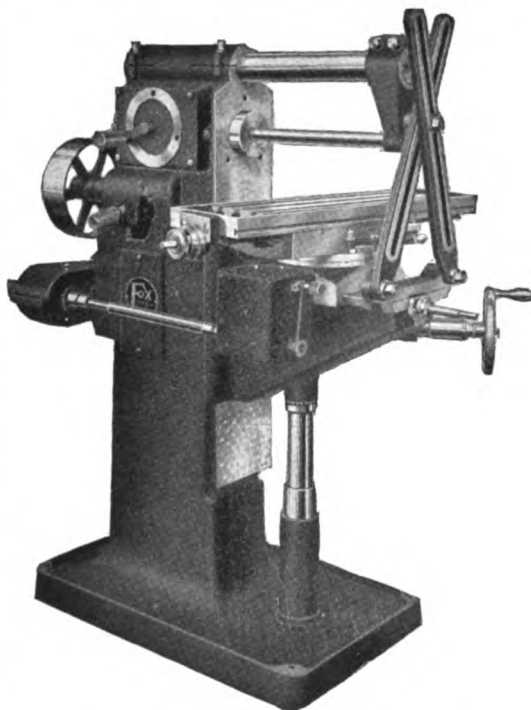
Capacity of machine 3" radius  
either on convex or concave cutters  
up to 12" in diameter.

## FOX MACHINE COMPANY

1807 W. GANSON ST., JACKSON, MICH.

(Formerly at Grand Rapids, Mich.)

**Multiple Spindle Drilling Machines, Tube Cutters, Milling Machines, Universal Wood Trimmers, Miter Machines, Adjustable Grooving Heads**



### MILLING MACHINES

#### SPECIFICATIONS

##### 2-A Universal Miller

Taper in spindle, No. 9.  
B & S.

Table, over all,  $8\frac{1}{2}$  x 27.

Table, working surface,  
 $8\frac{1}{2}$  x 17.

Longitudinal power feed,  
17".

Transverse hand feed, 9".

Vertical hand feed,  $14\frac{1}{2}$ ".

Table to spindle (max.).  
14".

12 Speeds, 22 to 425  
R. P. M.

6 Feeds, .003" to .014"  
per rev. of spindle.

4" Swivel Vise.

10" Universal Dividing  
Head.

Spiral Cutting Attach-  
ment

1" or  $\frac{3}{8}$ " Arbor.

**2-A Universal Miller** is built with hardened gears throughout; bearings of knee, saddles and table have large wearing surfaces; machine equipped with Dividing Head and Spiral Cutting Attachment make it most desirable for large variety of work.

**2-B Plain Miller.** Machine is of the same general construction as the 2-A, excepting it has plain table  $36$ " x  $8\frac{1}{2}$ ", and rack feed for table; bearing in saddle  $22$ "; dividing head and spiral attachment not part of equipment.

**3 and  $3\frac{1}{2}$  Plain Millers.** These machines have cone pulley drives, and can be equipped with internal back gears in cone pulley; ATTACHMENTS. 4", 5" or 6" plain or swivel vises, 8" or 10" Universal Dividing Heads, oil pump, and 1" or  $\frac{3}{8}$ " Arbors are furnished at extra price.

## FOX MACHINE COMPANY

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### MULTIPLE SPINDLE DRILLS

DRILLING

REAMING

TAPPING

COUNTERBORING

**Types.** Machines are built in several sizes from small, sensitive machines for light work to heavy, massive machines for large work.

**Heads.** Various size heads can be furnished for each machine.

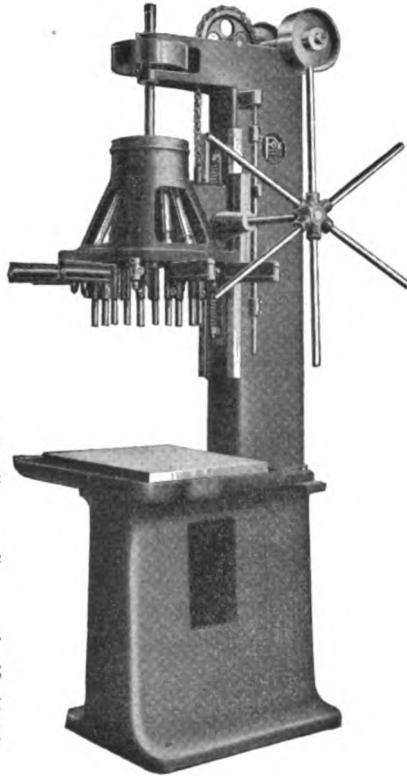
**Spindles.** Size of spindles is determined by size drill to be driven; patented spindle construction, giving quick vertical adjustment, is standard equipment.

**Universal Joints.** The "Fox" patented three-piece Universal Joint eliminating all pins, screws and rivets is used exclusively on these machines.

**Independent Drill Speeds** permit drilling large and small holes, reaming, counterboring, spot facing, etc., simultaneously, with the various size tools working at approximately correct speeds. Neutral position for all spindles not in use saves power and wear on spindles and gearing.

**Tapping Attachments.** Expansion ring type running in oil can be furnished.

**Cluster Plates (Patented)** are recommended for complicated layouts; we provide individual vertical adjustments for each drill.

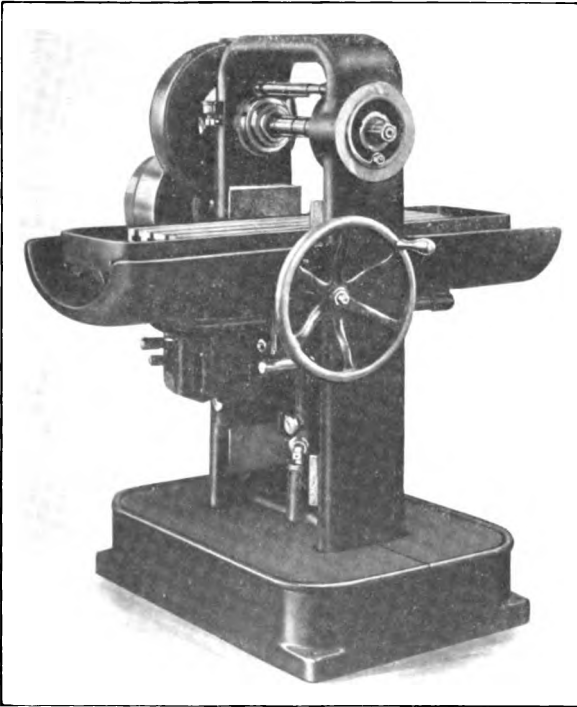


## **GOOLEY & EDLUND, INC.**

CORTLAND, N. Y., U. S. A.

**Manufacturers of High Duty Milling Machines**

### **BRIGGS MILLING MACHINES**



#### **FEATURES:**

—  
**CONVENIENCE  
OF OPERATION**

—  
**HIGH  
PRODUCTION**

—  
**RIGIDITY**

—  
**POWER**

—  
**SIMPLICITY**

—  
**ALIGNMENT**

—  
**AMPLE MEANS  
FOR  
LUBRICATION**

—  
**WORKMANSHIP**

—  
**DURABILITY**

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A manufacturing machine particularly adapted to the making of automobile, gun and similar parts where close limits and smooth cutting is required in the rapid production of duplicate parts.

A radical departure has been made from conventional milling machine design to secure greater rigidity and power than is possessed by any other machine of corresponding size and weight. The solid arched frame with the heavy bed strongly gibbed to both sides give a rigidity of relation of arbor to table which is not disturbed by the stress and vibration of heavy cuts of high speed or hard steels.

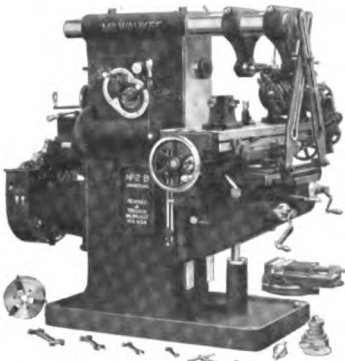
The powerful rigid feed, quick table return, ease and speed of handling, and simple and rigid construction are a few of the good features which we would like to tell you more about.

# KEARNEY & TRECKER CO.

MILWAUKEE, WIS., U. S. A.



NO. 2B PLAIN



NO. 2B UNIVERSAL



NO. 2 1/2 B VERTICAL

## MILWAUKEE MILLING MACHINES

**Double Over Arm  
Constant Speed Drive**

**Automatic Flooded Lubrication**

The Double Over Arm is clearly shown by the half-tone engravings and consists of two steel bars arranged accurately parallel with the spindle at sufficient distance apart to form a rigid truss when the arbor supports are clamped to them.

The Work Table is made of semi-steel and finished all over as experience has shown that where scale is left on one side the table does not long retain its accuracy.

The Box Section Knee has no slot through the top to close under pressure of the saddle clamp or strain of the cut.

The Flanged Spindle provides means for holding the cutters for driving in either direction. The clutch collar keyed to the face of the spindle provides an ideal drive for the arbors.

The Spindle Reverse is contained within the machine so that right- or left-hand cutters can be used without reversing the driving belt.

The Drive is through a single pulley running at a constant speed, giving 18 spindle speeds in geometrical progression of about 20 per cent.

The Lubricating System consists of a reservoir in the base of the machine holding several gallons of machine oil that is pumped to the top of the machine and distributed by a perforated pipe to all gears and bearings in the main frame and feed box, flooding downward over all of these on its way back to the reservoir. All oil grooves are cut through so that the oil will wash away any foreign material and keep the bearings in perfect condition.

A Cutter Lubricant Pump is provided on every machine as all machines are usually used on steel or other material requiring lubricant. Adequate provision has been made for the return of the lubricant to the reservoir.

*Catalogue describing our complete production in detail, mailed on request.*

## SLOAN & CHACE MFG. CO., LTD.

OFFICE AND WORKS

SIXTH AVE., COR. N. 13TH ST., NEWARK, N. J.

Manufacturers of Precision Machinery, Dies and Special Tools

**Products:** Bench Lathes, Bench Milling Machines, Special Machinery, Jigs, Fixtures, Punches and Dies for Sheet Metal, Gauges, Countershafts, Etc.



No. 5 1/2 Bench Lathe

### NO. 5 1/2" BENCH LATHE

With Compound Slide Rest

CAPACITY: 7" swing, 18" between centers (bed 35 inches long), 5/8" through draw-in spindle, 3/4" with draw-in spindle removed.

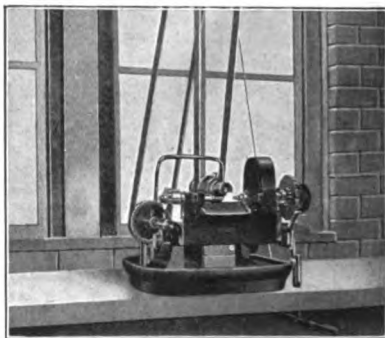
### AUTOMATIC PINION CUTTERS

CAPACITY: No. 1, 3/4" diameter, 1" face; No. 2, 1 5/8" diameter, 1 1/2" face.

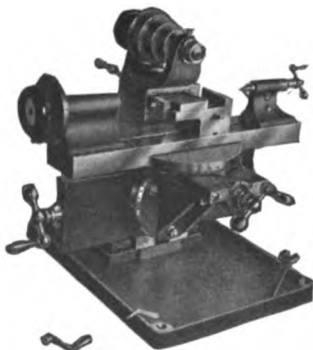
Automatic Pinion Cutters are built in two sizes, designated as Nos. 1 and 2. The No. 1 machine (illustrated) has a capacity up to 3/4" diameter and 1" face. The No. 2 machine is similar in construction to the No. 1, but larger, and having a capacity for gears and pinions up to 1 5/8" diameter and 1 1/2" face.

These machines are designed for the rapid production of cut pinions and small spur gears for watches, clocks, typewriters, etc., and both the No. 1 and No. 2 machines are built in three styles—to carry one, two or three cutters.

SPEEDS: Cutter spindle, 1600; worm shaft, 1200; countershaft, 750; cutter feed, 0.07 per revolution.



No. 1 Automatic Pinion Cutter



Bench Milling Machine

### BENCH MILLING MACHINES

Bench Milling Machine is designed for use in the tool room, or for experimental work, though it is adapted to some classes of manufacturing. It is mounted upon the bench, or a cast iron pedestal 36" high.

### COUNTERSHAFTS

Suitable Countershafts are provided for all of our many different machines. Lathes are required to perform such a great variety of work and under such varying conditions that we have found it necessary to provide several kinds of countershafts for them. They are Wall Countershafts, both two and three speeds; Wall-Rod Countershafts, one ("single") and two speeds; Grinding Countershafts, used with either Wall, or Wall-Rod Countershaft.

We build Special Machinery to individual order, assisting in its development and perfection. Fine Model Making and Gauge Work.

## THE WHITNEY MFG. CO.

HARTFORD, CONN.

**Chains—Keys—Hand Milling Machines**

### **"WHITNEY" CHAINS** are Efficient Transmitters of Power



**Silent Type**

for driving generators, pumps, compressors, machine tools, magnetos, lighting and starting systems, cam shafts, etc.

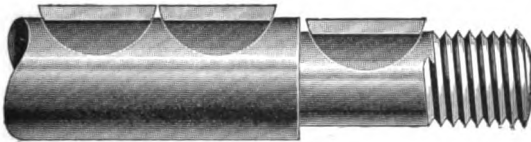
Our engineering department will be glad to assist you in order to secure maximum efficiency and service.



**Roller Type**

used by the leading makers of motor trucks, and rendering satisfactory service every day in the year.

"Whitney" roller chains are furnished either detachable or riveted to suit the customer.



### **WHITNEY KEYS AND CUTTERS** for The Woodruff System of Keying

The Whitney Key reaches deeper into the shaft than one of ordinary construction and is therefore capable of standing a much greater strain. It is impossible for a Whitney Key to roll over in its seat. The operation of cutting the key seat is simple and rapid and requires no skilled labor.

### **THE WHITNEY HAND MILLER**

is an all-round machine capable of taking both light and heavy cuts. It is of so substantial a construction that it can be used in place of larger tools costing twice the money.

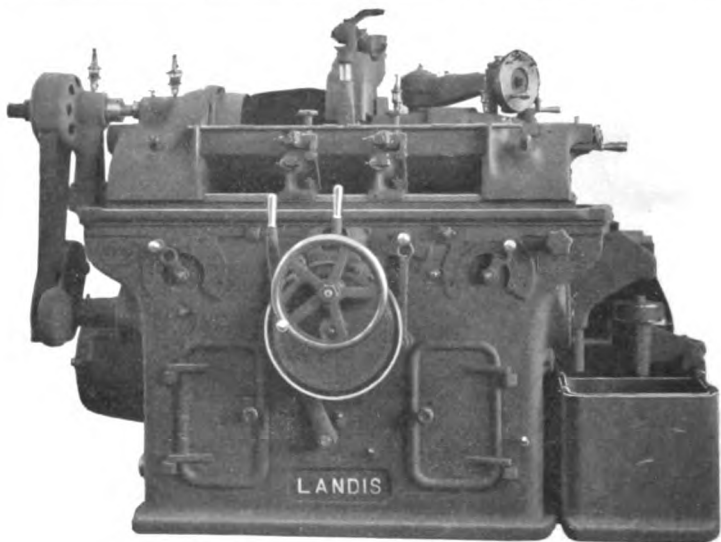
With it you can cut gears, cams, sprockets, do key-seating, profiling, slotting, slabbing, straddle milling and countless other operations.



## LANDIS TOOL COMPANY

WAYNESBORO, PA.

Manufacturers of Precision Cylindrical Grinding Machines



Improved Self-Contained Grinding Machine

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Our regular line consists of the following types:

**UNIVERSAL MACHINES** No. 1, No. 1½, No. 2, No. 3, No. 4 are used for finishing tools and a variety of straight or taper parts, both external and internal, such as are common to the tool room, machine shop, railroad shops, etc.

Attachments, such as magnetic chuck, gear-cutter attachment, side mill grinding attachment, etc., can be used on these machines to advantage.

**PLAIN GRINDING MACHINES.** Sizes 6", 10", 12", 20", 30", 40" swings in standard lengths. These strictly manufacturing machines are intended for finishing straight and taper spindles, shafts, rolls, tubing and all other work which can be revolved on dead centers.

**PLAIN GRINDING MACHINES WITH GAP** are our 16" and 20" swing. Plain Machines, built with gap in the bed to suit the location of the projection on the work. Especially suitable for grinding locomotive piston rods.

**INTERNAL GRINDING MACHINE** for straight and taper internal grinding and the fixtures for these machines will grind holes ¼" in diameter, or larger, and up to 12" long.

**CRANK GRINDING MACHINE** for grinding single or multiple throw crank shafts used in gas and small steam engines.

**ROLL GRINDING MACHINES** for grinding chilled iron and hardened steel rolls.

**CAM GRINDING ATTACHMENTS** (for use on our plain and universal grinders) for grinding either detachable or integral cams.

**BALL BEARING RACE GRINDING MACHINE** for grinding the raceways in radial, thrust and cone ball bearings.

Our illustrated and descriptive catalogue and literature gives detailed information. It also describes the features which stand for quick manipulation, accurately finished work, durability of alignments and rapid production—all of which are prominent in the various types of Landis Grinding Machines.

**LANDIS**

TRADE MARK



## MODERN TOOL COMPANY

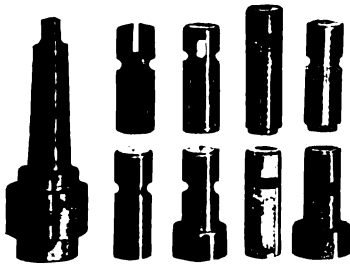
ERIE, PENNA., U. S. A.

**Manufacturers of Plain, Universal and Internal Grinding Machines, Self-Opening Dies, Collapsible Taps and Quick Change Chucks**

### "MODERN" SELF-OPENING DIES AND COLLAPSIBLE TAPS



"Modern" Threading Tools are universal in their application and use, being adapted for revolving spindles as well as turret lathes and screw machines. A single style of Die or Tap will cut any form or pitch of thread, of any diameter within the capacity of the respective heads. "Modern" Die Heads are made in sizes to thread any diameter from  $\frac{1}{16}$ " to 6", and the range of "Modern" Collapsible Taps is from  $\frac{3}{4}$ " to 3".



"Magic" Chuck and Collets

### "MAGIC" CHUCK EQUIPMENT

For the rapid changing of tools in drill press, lathe, screw machine, etc., without stopping the machine, practically converting a single spindle machine into a multiple spindle one, with as many tools as you may have operations. Made in six sizes, the largest with capacity up to 5" diameter drills. Try it and save labor costs.

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### "MODERN" GRINDING MACHINES

"Modern" Self-Contained Grinding Machines have a single constant speed drive, which reduces the cost when equipping the machines with motors. The main drive is in the rear of the machine and power is applied either from the line shaft by a single belt or by motor connection.

"Modern" Plain Type, Self-Contained Grinding Machines are made in sizes ranging in capacity from 18" to 60" between centers, and up to 16" swing.

"Modern" Self-Contained Crank Grinding Machines are adapted for grinding and finishing single and multiple throw crank shafts, including those used in the manufacture of gas engines or motors for automobiles and launches.

*Specifications on Universal and Internal Types on application.*

The above types are strictly manufacturing machines, designed to withstand the class of service required of grinding machines of this character, and embody many new and improved features which enable them to produce accurate, highly finished parts, rapidly and economically.

*Send for illustrated literature.*



"Modern" 8' x 30' Plain Self-Contained Grinding Machine

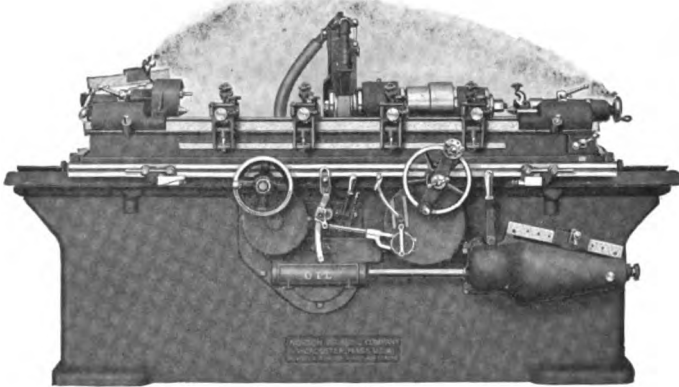
# **NORTON GRINDING COMPANY**

**WORCESTER, MASS., U. S. A.**

*Cable Address: "GRINCO"*

**A. B. C., Lieber's, Business, New Business and Western Union Codes  
Manufacturers of Grinding Machinery**

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## **PLAIN MACHINES FOR CYLINDRICAL GRINDING**

SWING —3'—6'—10'—14'—16'—18'—20'—22'—24'—26', and of  
VARIOUS LENGTHS between centers.

## **SURFACE GRINDING MACHINES**

WIDTH OF TABLE —15", distance between wheel and table 15".  
LENGTH OF TABLE —6'—8'—10'—12'—14'.

## **CRANK SHAFT GRINDING MACHINE**

## **UNIVERSAL TOOL AND CUTTER GRINDING MACHINES**

SIZE No. 1. CAPACITY 8" or 10", SWING 15" between centers.  
SIZE No. 2. " 10" or 12", " 32" " "

## **ROLL GRINDING MACHINES**

BUILT TO ORDER.

## **CAR WHEEL GRINDING MACHINES**

For grinding mounted car wheels while revolving on their own journals.

## **RUNNING BALANCE INDICATING MACHINES**

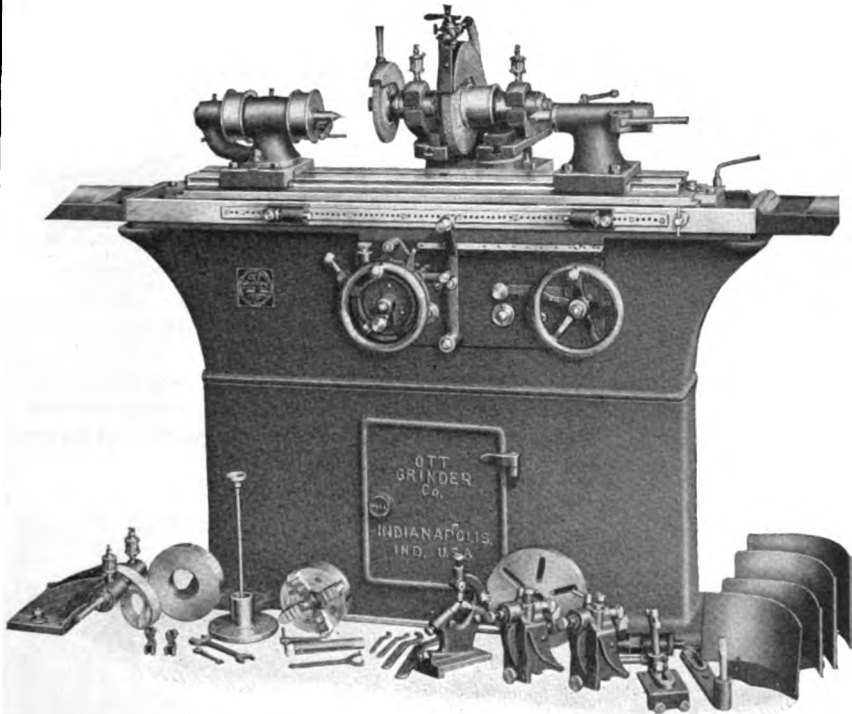
This machine is made for locating errors in running balance of revolving parts. Particularly adapted for automobile crankshafts, fly-wheels and clutches. Also armatures for small motors.

*Send for Illustrated Literature.*

## OTT GRINDER CO.

INDIANAPOLIS, IND.

Manufacturers of Cylindrical Grinding Machines



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### No. 2 Universal

Our Line comprises:

**No. 1 Universal 5' x 16"—Wheel 8' x  $\frac{3}{4}$ "**

**No. 2 Universal 9' x 26"—Wheel 10' x 1"**

These Universal Machines are especially adapted for general tool room service, for finish cylindrical grinding, straight and taper, chuck and face plate work both internal and external and also for general manufacturing grinding in above ranges and capacities.

**No. 8 Plain, 5' x 12"—Wheel 10' x  $1\frac{1}{4}$ "**

This machine is especially adapted for the economical production of small duplicate straight or taper cylindrical parts requiring close limits. A wheel up to 2' face can be used.

Greatest possible care and attention is given the manufacture of these machines; the materials used are the very best for their respective places and duties.

A complete system of inspection, first of the individual parts, then the assembly units and finally machine completed, "run and tested" insures the purchaser a perfect Grinder ready for instant use and production.

*Illustrated and descriptive bulletins with detail specifications gladly furnished.*

## J. FILLMORE COX ENGINEERING & TUBE BENDING MACHINE WORKS

BAYONNE, N. J.

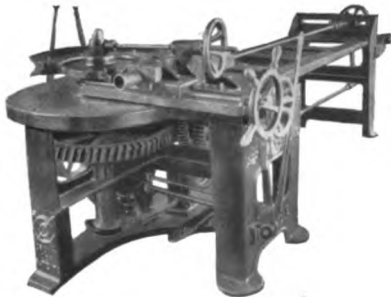
### MODERN TUBE-BENDING MACHINES

Produce any conceivable shape or style bend on pipe or tubing, cold, without filling, regardless of the nature of the material.



Type C No. 2 Electric. Capacity 8" Steel and Iron, and 8" Copper  
Larger Machines Up to 30" Diameter

We manufacture 23 different types and sizes of standard machines and various special requirements. To meet all requirements. Any shape or style of bend may be produced on all machines within its range and capacity, regardless of its nature of material or thickness of wall.



Type A No. 2, Belt Driven



Typical Bends Produced on Machines  
in Copper, Brass and Steel, Etc.

Suitable for all motor car and truck builders, ship yards, and wherever pipes or tubes are bent. All types made, either belt or electric driven.

Recently Installed in:

Packard Motor Car Co.

(4 machines)

Willys-Overland Auto Co.

(3 machines)

Elyria Iron & Steel Co.

Great Lakes Eng. Works.

American Ship Building Co.

(3 plants)

Brazilian and Russian Governments,  
and numerous others.

### COILING MACHINES OF ALL KIND

*Special Machines Designed and Built.*

COMMERCIAL PIPE AND TUBE BENDING BY CONTRACT

# KELLER MECHANICAL ENGRAVING COMPANY

68 WASHINGTON ST., BROOKLYN BORO, NEW YORK CITY, U. S. A.

**Die Cutting Machinery and Dies**

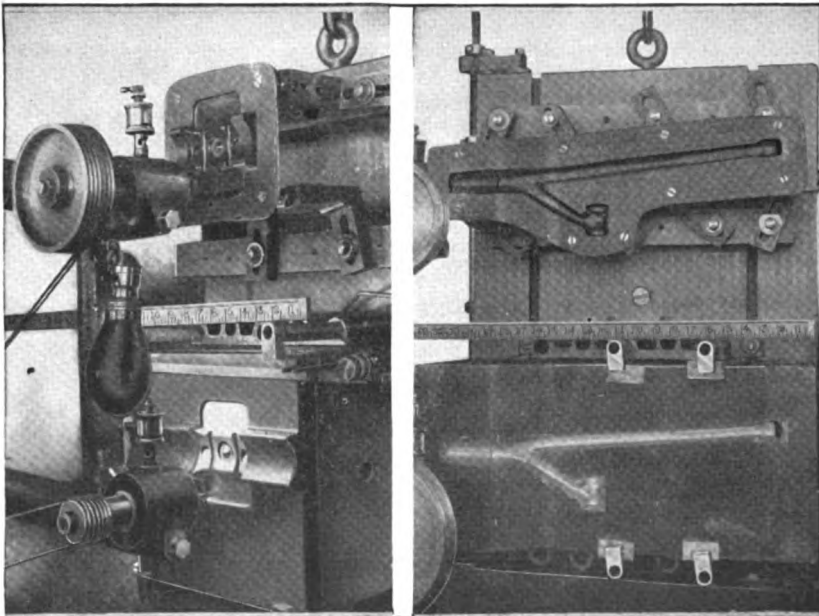
## **AUTOMATIC DIE CUTTING MACHINES**

With the constantly increasing demand for dies and moulds the supply of skilled labor has become entirely inadequate. The Keller Machines have solved this problem for industries requiring **FORGING** and **STAMPING DIES**. They are in use in the leading Drop Forge plants in America and Europe. Thousands of Forging Dies for Rifle and Automobile Components, Tools, Railroad and Marine Work, etc., are being turned out by this method. For **SHEET METAL EMBOSSING**, for **GLASS MOULDS**, for **LETTER CUTTING**, **COIN AND MEDAL WORK**, **PAPER EMBOSSING**, machines of various types are supplied.

Every engineer should be acquainted with the **MODERN METHOD OF DIE CUTTING**.



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**Spring Seat Die 12" × 12" × 9"**

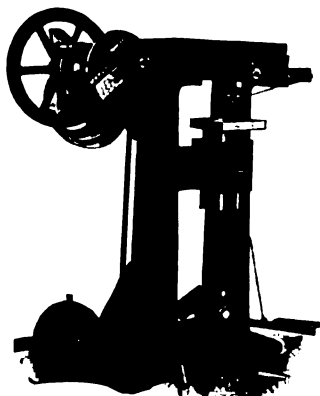
**Steering Arm Die 23½" × 11" × 10"**

**Details of Keller Machines Cutting Dies for Motor Car Parts**

## NOBLE & WESTBROOK MFG. CO.

HARTFORD, CONN., U. S. A.

**Manufacturers of Dwight Slate Marking Machines, Marking Devices of Every Description, Expert Die Cutting and Engraving, Filing Machines, Grinding and Polishing Machines**



Hand or Power  
Machines Recommended

**DWIGHT SLATE MARKING MACHINE**

**These Machines Will Mark Artistically Any Article or Any Material Suitable for Impressions**

A specialty of our line of manufacture is the making of devices and machines for placing on flat or round metal surfaces, impressions of trade-marks, patent dates, graduated scales and a variety of similar work. These machines are not expensive, are adapted to the work, do it in a superior manner at less cost than is possible on any makeshift devices.

A neat mark is desirable, adds to appearance of goods, and is a feature that the manufacturer cannot afford to ignore. Goods of all kinds are put on the market in more tasty and improved form than a few years since.

Both trade and purchasers call for these qualities. Antiquated and clumsy designs that were "good enough" are rapidly being displaced by improved forms and finish. By using modern machinery this is done at saving of original cost; therefore, when we offer better work at less cost we ask its consideration. Samples or sketches of work are solicited, proper machines recommended, and complete outfits furnished.

### DIE CUTTING BY EXPERT ENGRAVERS

**For These Machines a Specialty**

We have a large force of expert engravers familiar with the die cutting for these machines and in order to get the best results, we would recommend that you send us samples and let us furnish you the first equipment of dies and fixtures.

### NOBLE & WESTBROOK FILING MACHINE

**Use Any Standard File**

It is not necessary to babbitt the files or use other means to hold them in the head. An adjustable chuck is provided which will hold standard straight file, also making it easier for the operator to see the work. The N. & W. Die Filing Machine will do more and better work. Circular No. 300-A describes it.

### Special Machines for Marking and Graduating

Also we manufacture a full line of Grinding and Polishing Machines



Filing Machine

# THE VAN DORN ELECTRIC TOOL CO.

Electric Tool Specialists

## THE VAN DORN AND DUTTON CO.

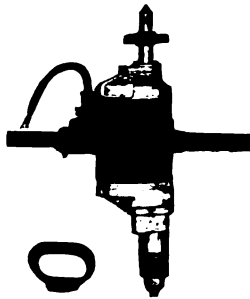
Gear Specialists

GENERAL OFFICES AND FACTORIES

CLEVELAND, O.

*The erection of big new factories equipped with the latest machinery gives both Van Dorn companies excellent facilities for supplying the demand for their respective products.*

### "Van Dorn" "HARD SERVICE" (PORTABLE) ELECTRIC DRILLS AND REAMERS



Made in various speeds for rapid production on bridge, structural and car reaming, general drilling, etc.

110-220 and 250 volt machines carried in stock.

The motors employed are of the straight series type, designed to withstand a 50% overload. Ball bearings are used on both ends of the armature shaft, ball type thrust bearings, hardened and ground gears with accurately generated teeth, quick make-and-break switches, and forced lubrication in lower head.

#### DIRECT CURRENT MACHINES

Type	CAPACITY STEEL		Weight	E. H. P.
	Drilling	Reaming		
D. C. 1	$\frac{1}{8}$ "	$\frac{1}{8}$ "	22 lbs.	.73
D. C. 2	$\frac{3}{16}$ "	$\frac{3}{16}$ "	28 "	1.32
D. C. 2x	$\frac{1}{4}$ "	$\frac{1}{4}$ "	38 "	1.47
D. C. 3x	1	$\frac{1}{2}$ "	40 "	2.07
D. C. 3	$1\frac{1}{4}$ "	$\frac{3}{4}$ "	69 "	2.95
D. C. 4	$1\frac{1}{2}$ "	$1\frac{1}{4}$ "	75 "	2.95
D. C. 5	2	$1\frac{1}{2}$ "	105 "	4.43

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Supplied with cable ready to attach to line.  $\frac{1}{2}$ " machines supplied with chucks when wanted.  $\frac{3}{4}$ " machines and larger supplied with Morse taper sockets.

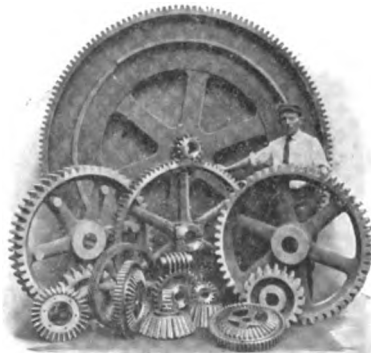
We also carry in stock universal machines for operation on D. C. and A. C. in  $\frac{1}{8}$ ",  $\frac{1}{4}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{3}{4}$ ", and 1" capacities.

### "Van Dorn" GEARS AND GEAR CUTTING

The Van Dorn & Dutton Co. specialize in gearing, and are prepared to furnish complete, machine complete, or cut only—to your specification—gears of all descriptions, for every class of service.

Our output includes spurs, bevels, spiral bevels, mitres, spirals, worms, racks, sprockets, rawhide pinions, etc.

An enlarged hardening and steel-treating plant is one of the features behind "Van Dorn" quality.



## LANDIS MACHINE CO., INC.

WAYNESBORO, PA., U. S. A.

**Manufacturers of Bolt Threading, Bolt Pointing, Nut Tapping, Pipe and Nipple Threading and Pipe Threading and Cutting Machines; Screw Cutting Die Heads and Chaser Grinder**

### THE LANDIS CHASER

The design of the Landis chaser is entirely different from any other type of die and it embodies features which insure a high production of clean-cut, well-formed threads at a minimum cost of die maintenance.

Distinctive Features of the Landis Chaser: Its length is such as to give a life many times that of any other die. It has a variable rake angle which permits of a grinding suitable for the material being threaded. It has a line contact with the stock, thereby reducing the friction to a minimum and permitting of exceptionally high cutting speeds. The throat or bevel is permanent insuring close shoulder work at all times. The chasers are interchangeable to the extent that any one or more of a set can be replaced without renewing the entire die. The chaser is milled and hardened its entire length, eliminating the necessity of annealing, hobbing and retempering. The chaser is sharpened by merely grinding it at the end. High speed steel can be used to better advantage than in any other type of die.



### THE LANDIS DIE HEAD

The die head is made entirely of steel. It has a diametrical adjusting mechanism which permits of a universal adjustment. The head is provided with an automatic opening and closing device which derives its action from the forward and backward travels of the carriage. This device is located within the head and carries all the cutting strain. It also serves to lock the head relieving the yoke of this duty. The head is graduated both right and left hand for all sizes within its range.

### THE LANDIS BOLT CUTTER

The Landis Bolt Cutter is designed to give economical service and accurate results. The frame is cast in one piece. An excellent die lubricating system insures a sufficient flow of lubricant at all times. The carriage is gibbed to the bed to compensate for any wear. The vises have a horizontal sidewise as well as a vertical centering adjustment permitting a perfect and permanent alignment with the die. All gears are inclosed to provide for the safety of the operation.

### THE LANDIS PIPE AND NIPPLE THREADING MACHINE

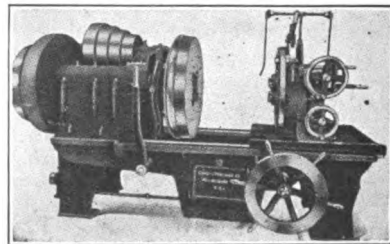
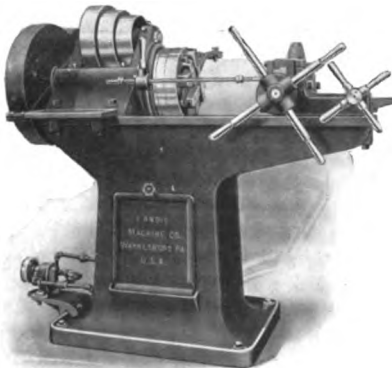
The Landis Pipe and Nipple Threading Machine is similar in design to the bolt cutter. It is equipped with a reaming device which removes the burr which forms during the cutting-off operation, while the pipe is being threaded. Nipple grips are provided with both plain and threaded surfaces to receive the blank and threaded pipe ends.

### THE LANDIS PIPE THREADING AND CUTTING MACHINE

The Landis Pipe Threading and Cutting Machine employs a stationary type die head. The entire range of each head with the exception of the 2" size is covered by but *one set of chasers*. The head is manually operated and under working conditions is locked within itself.

The machine is rigid in construction and its design embodies all features to facilitate production and to insure safety for the operator. The carriage supports the head, cutting-off tools, reaming device and length gauge, all located conveniently for efficient service.

**Catalogue No. 22—Bolt Threading Machinery.**



**Catalogue No. 23—Pipe Threading Machinery.**



# LANDIS MACHINE CO., INC.

## SPECIFICATIONS OF STANDARD BOLT CUTTERS

Type	Size	Range	Chaser Equipment Inches	R. P. M. Countershaft		Floor Space Required	Approx. Net Weight Lbs.
				Carbon Steel	H. S. Steel		
Single Head Machines	$\frac{1}{2}$ "	$\frac{1}{4}$ " to $\frac{1}{2}$ "	1 set each of $\frac{1}{4}$ , $\frac{1}{8}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , and $\frac{3}{4}$ .	180	300	1' 9"x4' 1"	850
	1"	$\frac{1}{4}$ " to 1"	1 set each of $\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , $\frac{3}{4}$ & 1	200	300	2' 3"x4'11 $\frac{1}{2}$ "	1350
	1 $\frac{1}{2}$ "	$\frac{3}{8}$ " to 1 $\frac{1}{2}$ "	1 set each of $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , 1, 1 $\frac{1}{2}$ and 1 $\frac{3}{4}$ .	300	450	2' 3"x4'11 $\frac{1}{2}$ "	1400
	1 $\frac{1}{2}$ "	$\frac{1}{2}$ " to 1 $\frac{1}{2}$ "	1 set each of $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , 1, 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , and 1 $\frac{3}{4}$ .	280	400	2' 3"x4'11 $\frac{1}{2}$ "	1400
	2"	$\frac{1}{2}$ " to 2"	1 set each of $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , 1, 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , and 1 $\frac{3}{4}$ .	225	400	2' 8"x7' 1 $\frac{1}{2}$ "	2200
	2 $\frac{1}{2}$ "	$\frac{3}{4}$ " to 2 $\frac{1}{2}$ "	1 set each of $\frac{3}{4}$ , $\frac{1}{2}$ , 1, 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , and 2.	300	500	2' 8"x7' 1 $\frac{1}{2}$ "	2300
	2 $\frac{1}{2}$ "	$\frac{3}{4}$ " to 2 $\frac{1}{2}$ "	1 set each of $\frac{3}{4}$ , $\frac{1}{2}$ , 1, 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , and 2.	300	500	2' 11"x8' 3 $\frac{1}{2}$ "	3000
	Long Bed 3"	1" to 3"	1 set each of 1, 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , and 3.	300	500	3' 7"x9' 1"	4200
	3 $\frac{1}{2}$ "	1" to 3 $\frac{1}{2}$ "	1 set each of 1, 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , and 3.	300	500	3' 7"x9' 1"	4400
	4"	1 $\frac{1}{2}$ " to 4"	1 set each of 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 2, 2 $\frac{1}{4}$ , 2 $\frac{1}{2}$ , 2 $\frac{3}{4}$ , 3, 3 $\frac{1}{4}$ , and 4.	300	500	3' 7"x9' 1"	4550
Double Head Machines	1"	$\frac{1}{4}$ " to $\frac{1}{2}$ "	2 sets each of $\frac{1}{4}$ , $\frac{1}{8}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , and $\frac{3}{4}$ .	180	300	2'10 $\frac{1}{2}$ "x4' 1"	1400
	1 $\frac{1}{2}$ "	$\frac{3}{8}$ " to 1 $\frac{1}{2}$ "	2 sets each of $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , and 1.	200	300	3' 6"x4'11 $\frac{1}{2}$ "	2250
	1 $\frac{1}{2}$ "	$\frac{1}{2}$ " to 1 $\frac{1}{2}$ "	2 sets each of $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , and 1.	300	425	3' 6"x4'11 $\frac{1}{2}$ "	2350
	1 $\frac{1}{2}$ "	$\frac{1}{2}$ " to 1 $\frac{1}{2}$ "	2 sets each of $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , and 1.	280	400	3' 6"x4'11 $\frac{1}{2}$ "	2400
	2"	$\frac{1}{2}$ " to 2"	2 sets each of $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , 1, 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , and 1 $\frac{3}{4}$ .	225	400	4' $\frac{1}{2}$ "x6' 4 $\frac{1}{2}$ "	3800
	2 $\frac{1}{2}$ "	$\frac{3}{4}$ " to 2 $\frac{1}{2}$ "	2 sets each of $\frac{3}{4}$ , $\frac{1}{2}$ , 1, 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , and 2.	300	500	4' $\frac{1}{2}$ "x7' 1 $\frac{1}{2}$ "	4050
	3"	1" to 3"	2 sets each of 1, 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , and 3.	300	500	9' 1"x7' 0"	7800
Triple Head Machines	1"	$\frac{1}{4}$ " to 1"	1 set each of $\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , and 1.	400	550	5' 4 $\frac{1}{2}$ "x4'11 $\frac{1}{2}$ "	3350
	1 $\frac{1}{2}$ "	$\frac{3}{8}$ " to 1 $\frac{1}{2}$ "	1 set each of $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , 1, 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , and 1 $\frac{3}{4}$ .	250	360	5' 4 $\frac{1}{2}$ "x4'11 $\frac{1}{2}$ "	3650
	2"	$\frac{1}{2}$ " to 2"	1 set each of $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{1}{2}$ , 1, 1 $\frac{1}{2}$ , 1 $\frac{3}{4}$ , 1 $\frac{1}{2}$ , and 2.	500	700	6' 1 $\frac{1}{2}$ "x6' 1"	5400

295

### Staybolt Machines

Sin. Head	1 $\frac{1}{2}$ "	$\frac{1}{2}$ " to 1 $\frac{1}{2}$ "	As desired	225	360	2' 3"x7' 3"	1450
Don. Head	1 $\frac{1}{2}$ "	$\frac{1}{2}$ " to 1 $\frac{1}{2}$ "	As desired	225	360	3' 6 $\frac{1}{2}$ "x7' 3"	2650

## SPECIFICATIONS OF STANDARD PIPE AND NIPPLE MACHINES

Type	Size	Range	Chaser Equipment (carbon steel)	R. P. M. Countershaft		Floor Space Required	Approx. Net Weight Lbs.
				Carbon Steel	H. S. Steel		
Sin. Head Mach.	$\frac{1}{2}$ "	$\frac{1}{4}$ " to $\frac{1}{2}$ "	1 set each 27, 18 and 14 Pitch.	180	400	1' 9"x4' 6"	850
	$\frac{3}{4}$ "	$\frac{1}{4}$ " to $\frac{3}{4}$ "	1 set each 27, 18, 14 and 11 $\frac{1}{2}$ Pitch.	300	425	2' 3"x5' 1"	1400
	1"	$\frac{1}{2}$ " to 1"	1 set each 18, 14 and 11 $\frac{1}{2}$ Pitch.	225	400	2' 8"x7' 8"	2200
	1 $\frac{1}{2}$ "	$\frac{3}{4}$ " to 1 $\frac{1}{2}$ "	1 set 8 Pitch.	300	500	9' 11"x3' 7"	4650
Don. Head Mach.	$\frac{1}{2}$ "	$\frac{1}{4}$ " to $\frac{1}{2}$ "	2 sets each 27, 18 and 14 Pitch.	180	300	2'10 $\frac{1}{2}$ "x4' 6"	1400
	$\frac{3}{4}$ "	$\frac{1}{4}$ " to $\frac{3}{4}$ "	2 sets each 27, 18, 14 and 11 $\frac{1}{2}$ Pitch.	300	425	3' 6"x5' 1"	2300
	1"	$\frac{1}{2}$ " to 1"	2 sets each 18, 14 and 11 $\frac{1}{2}$ Pitch.	225	400	4' 0"x6' 1"	3800
	1 $\frac{1}{2}$ "	$\frac{3}{4}$ " to 1 $\frac{1}{2}$ "	1 set 8 Pitch.	350	550	8' 1"x6'10 $\frac{1}{2}$ "	7850

## SPECIFICATIONS OF STANDARD PIPE THREADING AND CUTTING MACHINES

2"	$\frac{1}{2}$ " to 2"	1 set each 14 and 11 $\frac{1}{2}$ Pitch.	225	400	6' 8"x3' 2"	2650
4"	1" to 4"	1 set each 11 $\frac{1}{2}$ and 8 Pitch.	300	500	9' 10"x4' 4"	6600
2 $\frac{1}{2}$ "	$\frac{1}{2}$ " to 2 $\frac{1}{2}$ "	1 set 8 Pitch.	275	450	9' 10"x4' 4"	6600
8"	2 $\frac{1}{2}$ " to 8"	1 set each 8 Pitch and 8 Pitch.	225	400	9' 10"x4' 0"	10000

## GREENFIELD TAP & DIE CORP'N GREENFIELD, MASSACHUSETTS

STORES AT

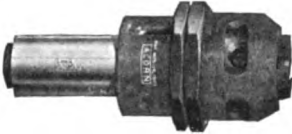
NEW YORK, 28 Warren Street

CHICAGO, 13 South Clinton Street

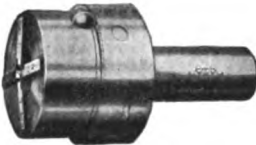
LONDON, 149 Queen Victoria Street

Canadian Factory, Wells Brothers Co., of Canada, Ltd., Galt, Ontario

**Manufacturers of Screw Cutting Tools and Machinery, Gages and Reamers**



Acorn Die and Holder



Wells  
Self-Opening Die



"Gun"  
Tap



Solid  
Reamer



Thread Limit Snap Gage



Our line of Tools and Machinery covers a broad field. We are essentially makers of Screw Cutting and Measuring Tools. The line, however, includes other Tools and Machines that are closely allied. A fairly comprehensive list follows. We want to supply you with catalogs and booklets. Please state what you are particularly interested in.

### SCREW CUTTING TOOLS

**Taps**—for every purpose from watch-making to bridge-building, including the shear cutting "Gun" Tap.

**Dies**—Wells Self-Opening Die, Acorn Die and Holders and a variety of Adjustable Dies for hand and machine use.

**Screw Plates**—More than one hundred different assortments of Taps and Dies to meet every possible requirement.

### GAGES

**Screw Thread**—Plug and Templet, Limit Snap Gages, Screw Pitch Gages, Screw Thread Micrometer, etc., made for all threads, forms and pitches.

**Cylindrical**—Plug and Templet and Adjustable Limit Snap Gages in all sizes.

**Special**—We design and manufacture Special Gages of any type and outline complete gaging systems for any product.

### REAMERS

**Spiral Fluted**—Reamers of all types and sizes, the spiral flutes give the lands a shearing cut, and they will not chatter or "hog" in.

### PIPE TOOLS

**Stocks and Dies**—"Trio" and "Duo" combinations always ready for work, Stocks with O. K. Forged Dies, "Economy" Malleable Dies and Armstrong Type of Adjustable Dies. Also complete tool sets.

**Wrenches, Cutters and Vises**—A line of pipe tools that has always been popular.



## GREENFIELD TAP & DIE CORP'N

### GTD MACHINERY

#### Threading Machines

We make a complete line of threading machines from the little, hand bench outfits to the large power machines with automatic opening die heads.

The machines are geared high as well as having an exceptionally rapid adjusting mechanism and because of these features they are equally good for threading both large lots and on job work.

#### Tool and Cutter Grinders

"Wells" Tool and Cutter Grinders are made in both the Plain and Universal types. The Plain Grinder for either bench or floor use will handle any work which may be ground on the periphery of the wheel. In the Universal Grinder the table is provided with both vertical and radial adjustments so that all classes of work may be ground.

#### Lathes

The "Wells" line of lathes has been marketed for several years by F. E. Wells & Son Co. Division. It includes Speed Lathes, Manufacturers' Lathes and Manual Training Lathes. Any of these may be had with individual motor drive at the purchaser's option. The Manual Training Lathes are also furnished with a shaft underdrive which embodies a four-speed changing device.

#### Hand Screw Machines

"Wells" Hand Screw Machines will handle stock up to 1" diameter. They are provided with wire feed, four- or six-hole turrets and positive lubrication.

The six-hole turret indexes automatically and its under side forms a cam which regulates the stops. It is impossible for this turret to overrun a stop so that it may be operated by unskilled labor without danger to machine or work.

#### Cutting-Off Machine

Nutter and Barnes High Power Cutting-Off Machines (capacity from 0 to 12" dia.) meet every modern metal cutting requirement—accuracy, speed, ease of operation and dependability. Developed to top notch efficiency, they have greater capacity, size of saw considered, than any similar machine on the market.

Extra powerful drive, single lever control for starting and stopping feed and forced lubrication are some of the important features.

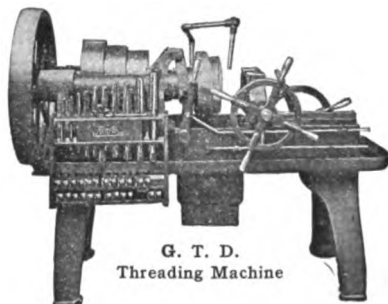
#### Saw and Cutter Sharpeners

For sharpening either plain saws or saws with B & S patent relieved teeth, the Nutter and Barnes saw sharpener is recommended. The automatic sharpeners work with the precision of a well-timed clock.

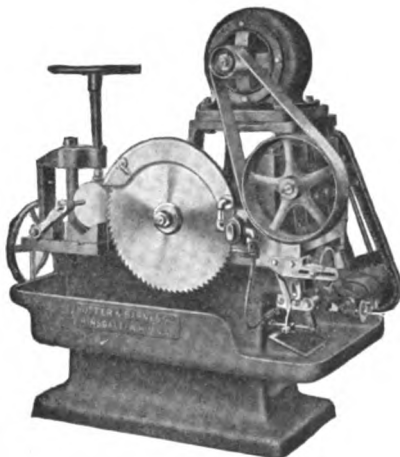
The teeth are spaced evenly and radially from an index plate which is cut accurately with the same number of teeth as the tool—not from the tool itself. The various models have a capacity of from 2½" to 36" saws and will handle cutters from 2½" diameter up.



"Wells" Universal Grinder



G. T. D.  
Threading Machine



N. & B. Cutting-Off Machine

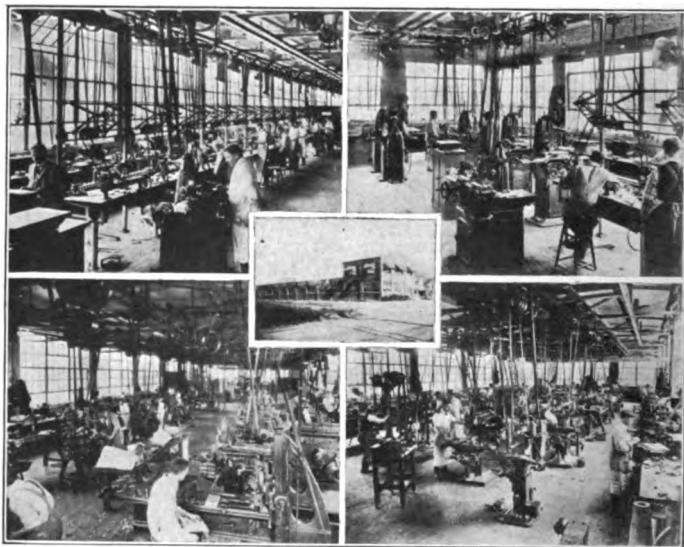
## MEHL MACHINE TOOL & DIE CO.

OFFICE AND WORKS

ROSELLE, NEW JERSEY

AT LORRAINE STATION

**Designers and Builders of Semi and Automatic Machines, Special Machinery, Tools and Dies, Sub-Press Dies**



Exterior and Interior Views of the Mehl Plant

**TRADE MARK**  
**MEHL MADE**

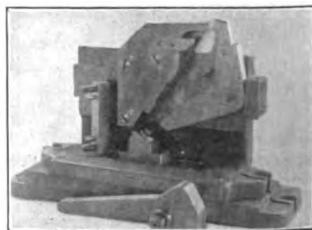
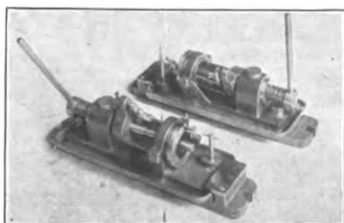
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We have chosen our workmen with the greatest care—each is an expert in his line.

These advantages combined with long experience in the making of better tools, are reasons why you will be serving your best interests by sending us your next order. We are sure you will be perfectly satisfied with both the price and quality of our work.



Accurate Milling Fixtures

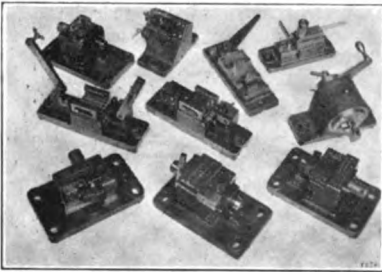
## MEHL MACHINE TOOL & DIE CO.

**TRADE MARK**  
**MADE**

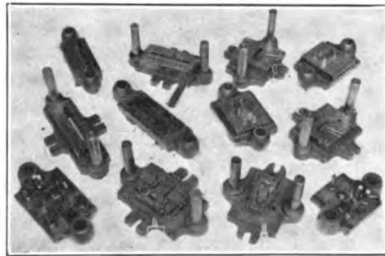
The purpose back of our organization is to assist you in *your* manufacturing, through the making of accurate jigs, fixtures, dies and tools.

Our shop contains a complete equipment of the best high-grade precision tools, manned by a corps of experts. Our engineers are ready to design your special work, whatever its nature.

Our past experience covers a broad field, including all requirements as illustrated in the various groups below.



**Milling and Indexing Fixtures**



**Complicated Dies**



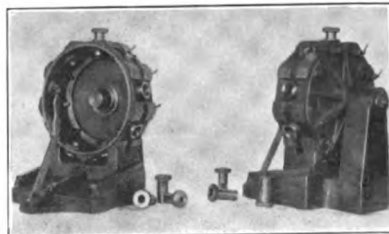
**Drill Jigs and Fixtures**



**Variety of Gages**



**Variety of Small and Large Jigs**



**Large Indexing Drill Jig**

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### **Makers of Saws and Tools**

Branches carrying complete stocks in all large distributing centers, as follows:

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Paris, France

### **ATKINS "KWIK-KUT" METAL CUTTING MACHINES**

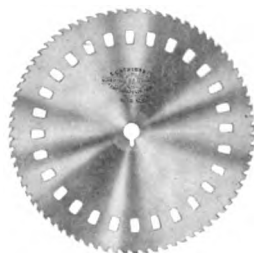


Automatically regulate the stroke, using practically the entire toothed edge of the blade in cutting.

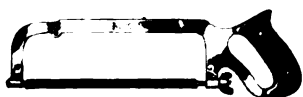
"Kwik-Kut" machines contain many other distinctive Atkins features that reduce expense and increase production. The machine illustrated is furnished either motor- or belt-driven suitable for cutting stock up to 8".

### **METAL CUTTING SAWS**

Atkins Circular Metal Cutting Saws are manufactured from steel specially formulated to withstand the rigors of severe service. Advanced methods of manufacture and an exclusive tempering process afford opportunities to get the best possible blades for Higley, Lea-Simplex, Q & C Bryant, and in fact any machine on the market.



### **HACK-SAW FRAMES**



Atkins Hack-Saw Frames show character in their construction. Their perfect balance makes them easy to operate and reduces the possibility of blade twists and breaks.

Atkins Frames are made in several different styles suitable for all kinds of work.

### **ATKINS NON-BREAKABLE HACK-SAW BLADES**

Atkins Non-Breakable Hack-Saw Blades are made with the usual hard edge, but with a soft back that prevents breakage.

The edge is tempered so as to insure a cutting capacity equal to "all hard" blades. While these blades will cut equally fast and hold their cutting edge as long as the "all hard" blades, the liability to break or snap off is entirely eliminated. A necessity in out-of-the-way spots or in shop use where inexperienced help is employed.



*Descriptive literature on Saws for Metal Cutting sent on request.*

# HUTHER BROS. SAW MFG. CO.

ROCHESTER, N. Y.

Manufacturers of Circular and Band Saws for Cutting Wood and Metal, Special Cutters, Discs, Knives and Patent Groovers



## HUTHER BROS. PATENT INSERTED TOOTH MILLING SAW

Thin Free Cutting Strong Flexible

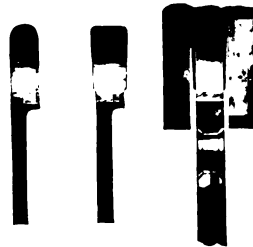
Two toughly tempered crucible steel plates firmly riveted together form the body of this saw.

The teeth or inserts are of the finest quality high speed steel and are formed so that grinding or sharpening is done on face of tooth only. This not only insures an easy and quick method of sharpening, but a tooth of great strength and long life as well.

The speed of this saw is recommended at from 35 to 55 peripheral feet per minute, feeding against the stock at the rate of  $\frac{1}{2}$ " to 2" and over per minute, according to the nature of the stock and the capacity of the machine.

The teeth have large throat room and ample clearance on both sides and back and are guaranteed to be free cutting and to require the minimum amount of power to operate.

The round top tooth is about  $\frac{1}{4}$ " higher than the square tooth and acts as a roughing tool, taking the chip from the center. The square tooth following removes the chips from either side of the cut. This breaking up of the chips, together with the double clearance of the square tooth, eliminates the possibility of this saw clogging when cutting soft, stringy stock.



Front View of Teeth

Showing round top and square top teeth in the different heights.



Another View of the Two Teeth  
Showing the Rivet Holes and Side and Back Clearance.

Widest cutting point of these saws, as follows: 14",  $\frac{1}{4}$ "; 18",  $\frac{1}{2}$ "; 26",  $\frac{1}{4}$ "; 30",  $\frac{1}{2}$ ".

**Fine Pitch:** We also manufacture this saw with close pitch tooth, about  $\frac{1}{2}$ " space from point to point. This is not a formed tooth and is not recommended except in cutting small diameter stock, structural steel, rails, etc.

In all stock over 2" or 3" the coarse pitch type gives the best results and can be depended upon to give the greater output.

Write for our Catalog

# THE CLEVELAND TWIST DRILL CO.

NEW YORK CITY  
30 Reade Street

Established 1874  
CLEVELAND, OHIO

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Catalog No. 319 Describes All "Cleveland"

DRILLS REAMERS  
COUNTERBORES  
SCREW EXTRACTORS



Trade Mark

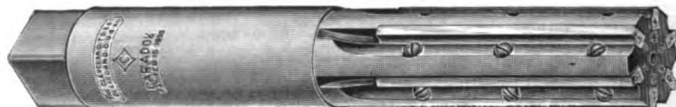
SOCKETS MILLS  
MANDRELS ARBORS  
HIGH SPEED TOOLS



"Paragon" Drills are not flat bars twisted while hot, but are twist drills *forged* from the original bar of high speed steel in special dies. This method produces correctly shaped flutes and toughens the metal. "Paragon" Drills hold the world's drilling record—57½ inches penetration per minute through cast iron. They may be adapted to Morse standard tapers by means of special sleeves.



"Peerless" High Speed Reamers (patented) have blades of high-speed steel united with the soft steel body by a patented process which produces a solid, one-piece reamer of unusual toughness, at an appreciable saving in manufacturing cost. "Peerless" High Speed Reamers are especially recommended for machine reaming and are furnished in all styles, *including expansion*.



"Paradox" Reamers (patented) combine many of the advantages of both solid and adjustable types. The body is of machinery steel, case-hardened where subject to wear, into which are inserted blades of tool steel. Taper headed screws wedge these blades firmly against their backing, the blades being counter-sunk at intervals along the shoulder at their base to fit the taper screw-heads.

One of the screws is placed near the end of the blade, giving firm support where most needed, and preventing the tool from "hogging in." This construction gives all the rigidity of a solid reamer.



**EZY-OUT Screw Extractors** (patented). The only tool designed for the express purpose of removing broken set and cap screws, studs and staybolts. Made in 12 sizes and three sets. A valuable adjunct to every shop.



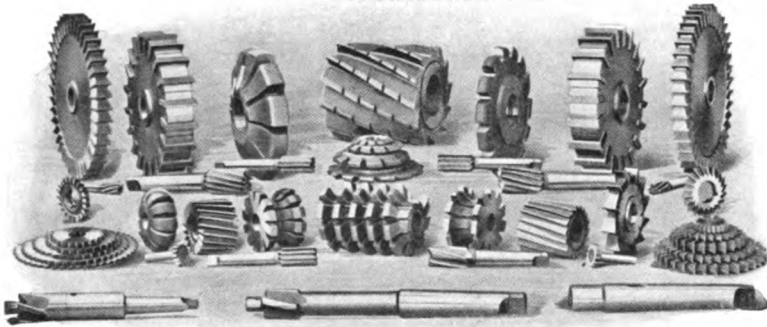
"Perfect Double Tang" Sockets (patented) have two driving slots instead of the usual one and afford a simple means of restoring old tools with broken tangs to their original usefulness. They will fit any spindle or socket having a regular taper hole.



# THE NATIONAL TOOL CO.

CLEVELAND, OHIO

Manufacturers of Milling Cutters and Special Tools



## NATIONAL CLEVELAND CUTTERS

**Plain Milling Cutters, Side Milling Cutters, Metal Slitting Saws, Angular Cutters, End Mills, Inserted Tooth Milling Cutters and Formed Cutters for Gear Wheels, Taps, Reamers, Twist Drills and Irregular Formed Cutters.**

303

Represent more than the best in clean cutting tools—more than mere dependability and durability.

There is more to them than the fact that they can be sharpened again and again.

They represent, because of their broad use and variety, a means of maintaining a minimum in your milling cost and a production standard for quality higher than can otherwise be obtained. Ask us to show you how.

*Our prices because of our large production are surprisingly reasonable, material costs considered. Immediate delivery—specialized service—write us.*

## THE NATIONAL PATENT INTERCHANGEABLE COUNTERBORE

The price of tool steel is soaring—there's no telling where it will stop. You can't do without it—the best you can do is to use no more than you need.

The National Patent Interchangeable Counterbore demonstrates the value of this practice applied to tool making. Of the three interchangeable parts, only the cutter is high speed steel. The pilot and shank are made of strong, durable, but less expensive steel—saving No. 1. The cutter is always the part that wears. If it's a "National," only the cutter need be renewed—saving No. 2.

*If you are interested in reducing your tool bill, write for circular.*

## THE McCROSKEY REAMER CO.

MEADVILLE, PA.

Manufacturers of Adjustable Reamers, Turret Tool Posts, Wizard Quick-Change Chucks and Collets, Wizard Variable Speed and Reversing Attachment for drill press, Searchlight Universal Lamp Brackets for shop and drafting room, Tap and Die Holders for Turret Lathes, and Other Cost-Cutting Specialties

### MCCROSKEY ADJUSTABLE REAMERS



If you are in any way personally responsible for reaming results in your shop, you should familiarize yourself with this line of reamers. All styles and sizes from  $\frac{3}{4}$ " to 10". High speed or carbon. Unequaled in design, unexcelled in workmanship and material, combining all the advantages of both solid and adjustable reamers without the disadvantages of either.

Hundreds of the largest and best shops have adopted these reamers as standard equipment. We solicit the privilege of figuring on your requirements.

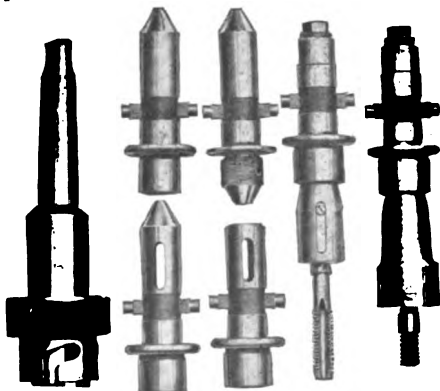
### WIZARD QUICK-CHANGE CHUCKS AND COLLETS

will revolutionize any drill press job where it is desired to use more than one tool in succession. Takes all sizes and kinds of tools, such as drills, taps, reamers, special tools, etc., in rapid succession without stopping the machine. On many

jobs will show 50% saving. Embodies several important features not found in any similar device. Wizard friction drive collets are unequaled for tapping and stud setting. Wizard No-Need-a-Tang collets reclaim broken tang drills and forever end all tang troubles.

Try a Wizard outfit on thirty days' approval and watch it make dollars for you. We take the risk.

Our complete catalog of cost-cutting tools sent on request.



## THE McCROSKEY REAMER CO.

### F-P-M TURRET TOOL POSTS FOR LATHES

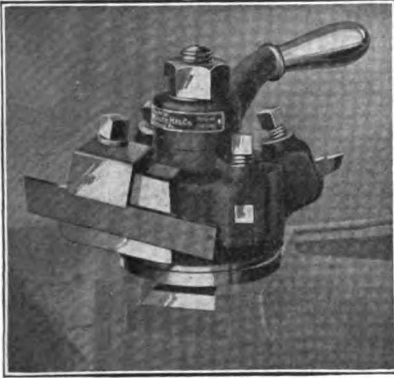


Illustration above shows Style F Turret. Made in four sizes, taking  $\frac{1}{8}$ ,  $\frac{3}{16}$ ,  $\frac{1}{4}$  and  $\frac{1}{2}$ " sq. bits. Cut-off tool may be removed and an extra sq. bit inserted. Style G Turret (not shown) is same as Style F except that it is 3-cornered, carrying 3 tools instead of 4.

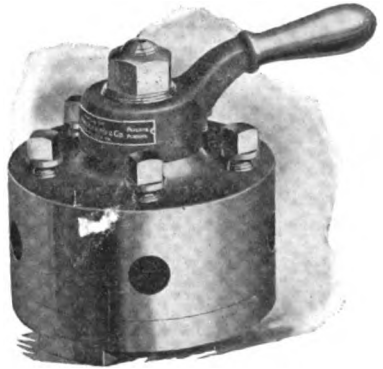
Illustration opposite shows Style M Turret for inside work such as drilling, reaming, etc. Diameter of Turret,  $6\frac{1}{2}$ ". Holes any diameter up to  $1\frac{1}{4}$ ".

*Catalog on request.*

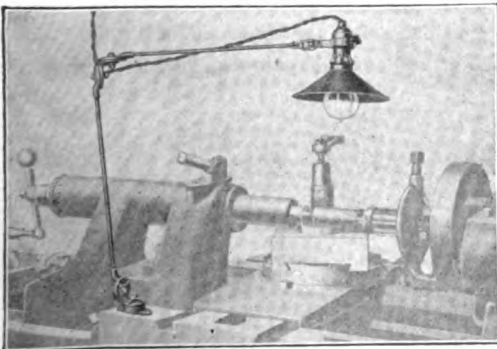
Converts any ordinary lathe into a Turret Lathe.

Attached directly to compound rest as quickly and easily as ordinary tool post. Has positive, accurate indexing mechanism.

Simple, strong and inexpensive. Advantages found in no other line of turret attachments. Will fit almost any lathe.



### THE SEARCHLIGHT LAMP BRACKET



Completely universal. Made in various styles to suit all factory and shop conditions. Puts the light where you want it when you want it. More output, better work, happier men. Saves globes.

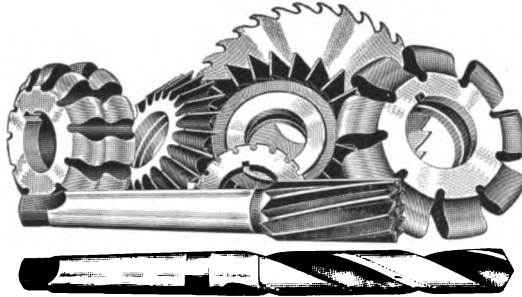
Only \$1.90 each with liberal discount according to quantity.

# **UNION TWIST DRILL CO.**

**ATHOL, MASS.**

**Manufacturers of Twist Drills, Gear and Milling Cutters**

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## **MILLING CUTTERS OF ALL DESCRIPTIONS**

We have had long experience in the manufacture of cutters and concentrating our energy on this class of tools enables us to offer a product which in quality of material and workmanship is strictly high grade.

Our cutters are very carefully made, and all are thoroughly tested as to shape, size, and temper before leaving our works. Teeth are spaced to give the most desirable results and are strong and well proportioned to withstand heavy cuts.

## **GEAR AND FORMED CUTTERS**

Formed cutters for the production of duplicate parts are made to order of any desired shape, and are most economical to use for irregular outlines. It is possible to make special cutters, gangs, milling cutters of all descriptions, and formed cutters for a wide variety of work.

Such cutters are particularly valuable for use in manufacturing duplicate parts owing to that feature which makes it possible to sharpen them by grinding the faces of the teeth without changing the form.

## **TWIST DRILLS AND REAMERS**

**COMPLETE EQUIPMENT FOR MANUFACTURE OF SPECIAL TOOLS  
IN ALL THESE LINES.**

*Complete Catalogue and Book of Information on request.*

# THE CARBORUNDUM COMPANY

NIAGARA FALLS, N. Y.

NEW YORK      CHICAGO      BOSTON      PITTSBURGH      PHILADELPHIA  
CLEVELAND      CINCINNATI      MILWAUKEE      MANCHESTER, ENG.

**Manufacturers of Abrasive Materials, Carborundum and Aloxite Grinding Wheels, Carborundum Paper and Cloth, Aloxite Cloth, Carborundum Brand Garnet Paper, Carborundum Sharpening Stones**

---

## THE RIGHT WHEEL IN THE RIGHT PLACE

This is the secret of efficient and economical grinding. Our service department is at your command to give you the benefit of years of experience in all classes of grinding—to give you proper wheel-right grit, right grade. Let us know about your grinding conditions—there is a Carborundum or Aloxite wheel to meet every grinding condition.

## CARBORUNDUM GRINDING WHEELS

FOR cast iron, brass, bronze, aluminum, general machine shop work, for cylindrical, internal or surface grinding of all metals of low tensile strength; for grinding pearl, marble, rubber, granite and porcelain.

## ALOXITE GRINDING WHEELS

FOR the grinding of steels of all kinds; malleable iron, reamers, cutters, drills, planer tools, knife grinding, cylindrical, internal or surface grinding where the material is steel.

*Made in any standard shapes or sizes, or in any special shapes or sizes subject to blueprints.*



TRADE MARK



TRADE MARK

## NORTON COMPANY

WORCESTER, MASS., U. S. A.

NEW YORK STORE

151 Chambers St.

Electric Furnace Plants

Bauxite Plant

BAUXITE, ARK.

CHICAGO STORE

11 N. Jefferson St.

Manufacturing Plants

NIAGARA FALLS, N. Y.—CHIPPAWA, CAN.

WORCESTER, MASS.—WESSELING, GERMANY

**Manufacturers of Alundum and Crystolon Grinding Wheels, Alundum and Crystolon Grain for Polishing, Alundum Refractories and Laboratory Ware, Glass Cutting Wheels, India Oil Stones and Crystolon Sharpening Stones, Razor Hones, Scythe Stones, Valve Grinding Compound, Rubbing Bricks and Stones, Grinding Wheel Dressers, and Grinding Machinery**

**ALUNDUM** ( $Al_2O_3$ ) is an artificial abrasive whose hardness, sharpness and toughness are under control during manufacture. This, in combination with its characteristic conchoidal fracture, makes Alundum Grinding Wheels particularly effective upon materials of high tensile strength—notably steel and its alloys.

**CRYSTOLON** (SiC) is another product of the electric furnace and because of its wonderful purity and remarkable cutting qualities, combined with its greater brittleness, this abrasive has proven highly efficient in grinding cast iron, brass, bronze, aluminum, glass, marble, pearl, and materials of like physical characteristics.

**NORTON GRINDING WHEELS** are made by four processes: the vitrified, silicate, elastic and vulcanite. In the vitrified process, the principal bonding ingredient is clay; in the silicate, sodium silicate is largely used; in the elastic process, the bond is made from a special mixture of shellac and other ingredients; while in the vulcanite process, a special form of vulcanized rubber is utilized.

Wheels can be furnished in various shapes and sizes to meet grinding requirements. Sizes run from as small as  $\frac{1}{8}$ " diameter to as large as 60" diameter, while the thinnest wheels made are  $\frac{1}{8}$ " thick, and the widest faced 28" thick. All wheels larger in diameter than 5" are subjected to a severe mechanical test before shipment to bring out any inherent weakness.

Wheels are classified by grain and grade, the grain numbers indicating the size of the abrasive cutting particles, while the grade denotes the measure of strength of the bond, or binding material in the wheel which holds the grain in its setting.

**REFRACTORIES**—Owing to the high refractory properties possessed by alundum this substance has been found unequalled for the manufacture of refractory and laboratory ware. Alundum is made into electric furnace cores, tubes, muffles, crucibles, combustion boats, filtering crucibles, cones, extraction thimbles and refractory cements.

**GLASS CUTTING WHEELS**—One of the most recent products developed by Norton Company is an assortment of Alundum glass cutting stones. These stones are of even texture throughout and possess no hard or soft spots, no sand holes or other defects. Every stone is trued to mitre and they will produce a sharp, clean cut; cut faster and last longer than any natural stone.

Any of these Booklets will be sent on request

Grinding Wheel Catalog  
Alundum—Crystolon Booklet  
Polishing—What to Use—How to Use It  
Norton Refractories—Alundum and Crystolon  
Saw Sharpening  
The Grinding of High Speed Steel

Norton Valve Grinding Compound  
Safety as Applied to Grinding Wheels  
Grinding Wheel Dressers  
Grinding Wheels for the Saw Mill  
Alundum and Crystolon in the Glass Industry  
Bushings Grinding Wheels

**SPECIAL RESEARCH SERVICE**—We have well-equipped research laboratories with a competent staff of research engineers and demonstrators who are always ready to give you the benefit of their special knowledge and wide experience in the solving of your special problems.

**Alundum**

TRADE MARK



**Crystolon**

TRADE MARK

# THE STERLING GRINDING WHEEL COMPANY

TIFFIN, OHIO, U. S. A.

CHICAGO HOUSE  
30-32 N. Clinton St.

NEW YORK  
The L. Best Co., 75 Barclay St.

**Grinding Wheels and Machinery**

Corundum

Artificial  
Corundum

Carbolon  
(SiC)



Vitrified

Silicate

Elastic

309

## A GRINDING WHEEL FOR EVERY PURPOSE

Sterling Wheels are made by three processes, Vitrified, Silicate, and Elastic. The Vitrified process is the usual bonding in clay. The Silicate process has Sodium Silicate as its base. The Elastic process is a special bonding material made up of Shellac and other ingredients.

Sterling Wheels will be furnished in any standard shapes, made by any of the several processes used, and from the best kinds of material which are to be had at the present time.

## GRINDING MACHINERY

We aim to furnish anything that is needed in the Grinding line and will be glad to have your inquiries and specifications. Prices are right. The goods are right. And Sterling Machinery will please you.



# THE HOGGSON & PETTIS MFG. CO.

NEW HAVEN, CONN., U. S. A.

Manufacturers of Lathe Chucks, Special Tools and Machinery, Rubber Mfr's Supplies, Roll Engraving, etc., Cutting Dies, Steel Stamps

## THE SWEETLAND INDEPENDENT CHUCKS

### PRICE LIST, DIMENSIONS, ETC.

Code	Size	Size of Hole	Diameter of Recess for Face Plate	Weight	Price
fable	4½ in.	1 in.	4½ in.	7 lbs.	\$20.00
fabric	6 in.	1½ in.	5½ in.	12 lbs.	22.00
facade	8 in.	1¾ in.	4 in.	28 lbs.	26.00
facile	9 in.	1¾ in.	5½ in.	32 lbs.	28.00
facet	10 in.	2 in.	5½ in.	42 lbs.	30.00
faction	12 in.	2½ in.	6½ in.	67 lbs.	35.00
faculty	14 in.	3 in.	6½ in.	84 lbs.	40.00
fagot	16 in.	3 in.	7½ in.	117 lbs.	46.00
faith	18 in.	4 in.	9½ in.	157 lbs.	54.00
falcon	20 in.	4½ in.	9½ in.	184 lbs.	62.00
fame	22 in.	5 in.	11 in.	217 lbs.	70.00
fancy	24 in.	5 in.	11 in.	267 lbs.	80.00
fashion	26 in.	5 in.	12 in.	315 lbs.	93.00
fastness	28 in.	5 in.	13 in.	350 lbs.	110.00
fargon	30 in.	6 in.	15 in.	430 lbs.	130.00



### DIMENSIONS

#### OF ALL

#### GEARED SCROLL CHUCKS

Numbers 6, 60, 61, 62, 63, 64, 65 and 66

Size	Net Weight Approx. 1 Set Jaws		Gross Weight Approx. 1 Set Jaws		Net Weight Jaws Per Set		Size of Hole	Diameter of Recess for Face Plate	Will Hold	Diameter of Swing
	3 Jaws	4 Jaws	3 Jaws	4 Jaws	3 Jaws	4 Jaws				
2½	.....	.....	2	.....	.....	.....	¾	1½	2½	2½
3	.....	.....	3½	4	.....	.....	¾	2½	3½	3½
4	7½	7½	7½	7½	¾	1	1	3	4½	4½
5	10½	11	11	11½	1½	1½	1½	3½	5½	5½
6	16½	16½	17½	17½	1¾	3	1½	4½	6½	6½
7½	26	28½	20	31½	3	4	2	4½	8½	8½
9	38	40	41	46½	3½	5½	2½	5	10½	10
10½	53	53½	61	61½	5½	7½	3	5½	11½	11½
12	69	73½	81	85	8	11½	3½	6½	13	12½
15	114	117	128	131	8	12	3½	6½	16	15½

COMMON Jaws Are Styles No. 61 and 62  
 REVERSE Jaws Are Styles No. 63 and 64  
 REVERSIBLE Jaws Are Styles No. 6 and 60

Three Jaw Chucks Styles No. 61, 63			Four Jaw Chucks Styles 62, 64		
Code	Size	Price	Code	Size	Price
ingot	2½ in.	\$14.00	inlaid	3 in.	\$19.00
inhal	3 in.	17.00	inmate	4 in.	21.00
inlet	4 in.	19.00	inmost	5 in.	23.00
install	5 in.	21.00	indorse	6 in.	27.00
issue	6 in.	24.00	induce	7½ in.	30.00
inward	7½ in.	27.00	indulge	9 in.	36.00
inveigh	9 in.	33.00	incuse	10½ in.	42.00
insect	10½ in.	38.00	india	12 in.	50.00
insight	12 in.	45.00	indigo	15 in.	65.00
inspid	15 in.	60.00			

TWO SETS OF JAWS ARE STYLES No. 65 and 66

Three Jaw Chucks Style No. 65			Four Jaw Chucks Style No. 66		
Code	Size	Price	Code	Size	Price
ingulf	2½ in.	\$17.00	incase	3 in.	\$22.00
inject	3 in.	20.00	inboard	4 in.	24.00
insist	4 in.	22.00	incage	5 in.	27.00
instep	5 in.	24.00	incise	6 in.	31.00
iris	6 in.	28.00	inclose	7½ in.	36.00
invest	7½ in.	32.00	incline	9 in.	42.00
inverse	9 in.	38.00	incrust	10½ in.	49.00
intrude	10½ in.	44.00	incur	12 in.	58.00
inform	12 in.	52.00	incurvate	15 in.	76.00
infiat	15 in.	70.00			

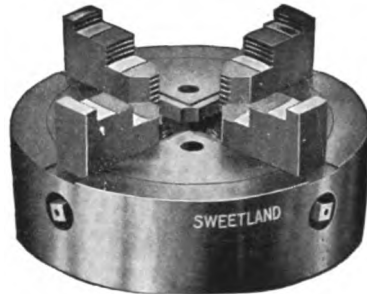


# THE HOGGSON & PETTIS MFG. CO.

## THE SWEETLAND COMBINATION LATHE CHUCKS



**WITH REVERSIBLE JAWS**



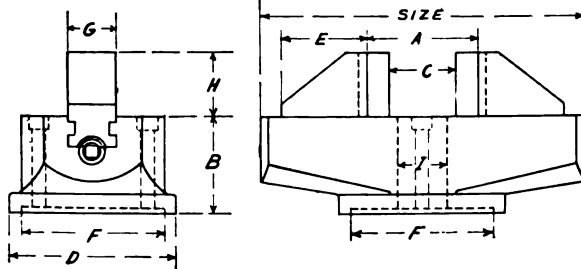
**WITH COMMON JAWS**

**These Chucks Can Be Furnished from Stock**

**With Three or Four Jaws as Desired**

Size Ins.	Net Weight Approx.		Gross Weight Approx.		Diameter of Swing	Will Hold	Size Ins.	Diameter of Recess for Face Plate	Price List	
	3 Jaw	4 Jaw	3 Jaw	4 Jaw					Three Jaw	Four Jaw
6	20	21	23	24	8	6 1/2	1 3/4	3 1/8	\$ 35.00	\$ 42.00
9	33	36	41	44	10 1/2	9 1/2	1 1/2	5	45.00	54.00
12	60	65	73	78	13 3/4	12 1/4	1 3/4	5 7/8	56.00	66.00
15	80	84	94	98	16 1/4	15 1/4	1 3/4	5 7/8	70.00	82.00
18	110	116	129	135	19	18 1/2	2	9	87.00	102.00
21	125	147	148	168	22 3/4	21 1/2	2 1/4	9	110.00	130.00
24	145	162	170	187	25 3/4	24 1/2	2 1/2	9	136.00	160.00
30	332	383	379	430	32	30 1/2	4 1/2	12 3/8	200.00	240.00
36	465	529	484	540	38 1/2	36 1/2	4 1/2	12 3/8	264.00	325.00
42	610	640	675	700	44 1/2	42 1/2	4 1/2	24	360.00	450.00

## THE SWEETLAND BOX BODY CHUCK



**Can Be Furnished as Universal or Independent. Slip Jaws, Tool or Soft Steel**

Size	Weight each	A	B	C	D	E	F	G	H	I	Code	Price
in.		in.	in.	in.	in.	in.	in.	in.	in.	in.		
7	20 lbs.	3	3	1 1/2	4 1/2	2	3 1/4	1 1/4	3 1/4	1 1/4	eared	\$28.00
9 1/2	38 lbs.	4	3 1/4	2 1/4	5 1/2	2 1/4	4 1/4	2	2 1/4	2	earl	33.00
12	50 lbs.	6	3 3/4	4	6	3	5	2 1/4	2 1/4	2 1/4	earth	40.00
15	75 lbs.	8	4 1/2	6	7 1/2	3 1/2	6 1/2	2 1/4	3	2 1/4	casel	50.00
18	100 lbs.	10	4 1/2	8	7 1/2	4	6 1/2	2 1/4	3 1/2	2 1/4	casve	75.00

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(Continued from preceding pages)

# THE HOGGSON & PETTIS MFG. CO.

## NEW HAVEN, CONN.

### HAND CUT STEEL LETTERS AND FIGURES



The proper grade of steel is used in the construction of these hand cut steel figures and letters. A size suitable for the letter to go on it is used, and is long enough so it can be held without hitting the fingers.

Size, inches	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$
Price, Figures, per set.....	2.50	2.00	1.50	1.50	1.50	1.50	1.50	1.50	1.75	2.00
Price, Letters, per set.....	7.50	6.00	4.50	4.50	4.50	4.50	4.50	4.50	5.25	6.00
Price, Letters or Figures, each.	.35	.30	.20	.20	.20	.20	.20	.20	.25	.30

Size, inches	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1
Price, Figures, per set.....	2.20	2.35	2.85	3.35	4.20	4.70	6.80	9.40	12.95	15.70
Price, Letters, per set.....	6.50	7.00	8.50	10.00	12.50	14.00	20.40	28.20	38.75	47.00
Price, Letters or Figures, each.	.30	.35	.40	.45	.60	.65	.80	1.10	1.45	1.75

### MARKING ROLL



### HAND CUT STEEL STAMPS



### HAND CUT STEEL STAMPS

Of all kinds and for all purposes. The work is all strictly hand cut, the letters being correctly shaped and the stamps properly tempered to suit the work they are to do. Price list is for plain letter hand stamps only.

Size, inches	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1					
Price, per letter	.20	.20	.15	.15	.15	.15	.15	.18	.20	.20	.25	.30	.40	.45	.50	.75	1.00	1.25	1.50

Stamps with letters over  $\frac{3}{8}$  inch will be charged extra at the rate of 50 cents per pound for steel and forging.

### MARKING ROLLS AND MACHINE STAMPS

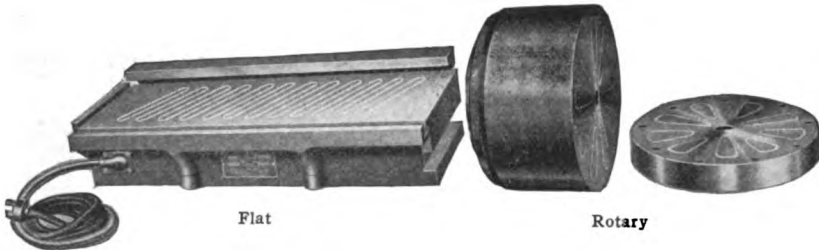
Estimates cheerfully given for machine stamps and marking rolls, completing or for cutting same only. Also for fancy lettering and special designs; stamps for difficult places and shapes.

# D & W FUSE COMPANY

PROVIDENCE, R. I.

## "D & W" MAGNETIC CHUCKS

Oil-Proof and Waterproof



"D & W" magnetic chucks are so designed as to make possible a wider range of work than has heretofore been considered practicable. This is effected by the use of a special form of narrow pole pieces made of mild steel. With this design a maximum effective holding surface is secured together with an exceptionally strong and uniform pull throughout.

The magnet coils in "D & W" chucks are wound and insulated by a special process which protects them from heat and moisture. This eliminates the expense of burnt-out coils.

The flat chucks are equipped with adjustable end and side stops, providing convenient means for locating and steadying the work on the surface of the chucks.

The above illustration of the rotary chuck shows same with an auxiliary plate. These plates are used as jigs or fixtures for the holding of special or irregular shaped pieces. By means of these plates, one chuck can be made to cover a wide range of operations, as any number of plates can be used with one chuck. All chucks are designed to operate on direct current circuits up to 250 volts.

Magnetic chucks can only be operated on direct current circuits.

In ordering chucks specify the voltage of lighting circuit.

### FLAT

Style	Extreme Holding Face	Extreme Base Dimension	Height	Price Each
F- 7- 8	8 $\frac{3}{4}$ x 7	8 $\frac{3}{4}$ x 6	4	\$ 60.00
F- 5-13	13 x 5 $\frac{3}{4}$	13 x 4 $\frac{1}{2}$	3 $\frac{1}{2}$	65.00
F- 7-16	16 $\frac{1}{2}$ x 7	16 $\frac{1}{2}$ x 6 $\frac{1}{2}$	3 $\frac{1}{2}$	80.00
F- 8-20	20 $\frac{1}{2}$ x 9 $\frac{1}{2}$	20 $\frac{1}{2}$ x 8	3 $\frac{1}{2}$	120.00
F-10-31	31 $\frac{1}{2}$ x 10 $\frac{1}{2}$	31 $\frac{1}{2}$ x 9 $\frac{1}{2}$	4 $\frac{1}{2}$	155.00
F-13-21	21 x 13 $\frac{1}{2}$	21 x 12	4 $\frac{1}{2}$	145.00
F-13-33	33 $\frac{1}{2}$ x 13 $\frac{1}{2}$	33 $\frac{1}{2}$ x 12	4 $\frac{1}{2}$	200.00
F-10-47	47 $\frac{1}{2}$ x 10 $\frac{1}{2}$	47 x 9 $\frac{1}{2}$	6 $\frac{1}{2}$	Special

### ROTARY

Style	Diameter	Width to Face Plate Seat	Diam. of Each Plate Seat	Price Each
R- 3	4 $\frac{1}{2}$	2 $\frac{1}{2}$	5 Morse Taper	\$ 40.00
R- 6	6	3 $\frac{1}{2}$	4	50.00
R- 8	8	3 $\frac{1}{2}$	4 $\frac{1}{2}$	60.00
R-10	10	3 $\frac{1}{2}$	5	75.00
R-12	12	4 $\frac{1}{2}$	5	100.00
R-14	14	4 $\frac{1}{2}$	7	Special
R-16	16	4 $\frac{1}{2}$	7	"
R-18	18	4 $\frac{1}{2}$	8	"
R-20	20	4 $\frac{1}{2}$	8	"
R-24	24	5	10	"

Complete catalogue mailed upon request.

# THE CINCINNATI BALL CRANK CO.

CINCINNATI, OHIO

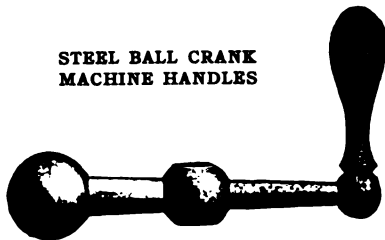
BRANCH OFFICE: 1316 Dime Bank Bldg., DETROIT, MICH.

Manufacturers of Steel Products

## HANDLES FROM STEEL

For power tools and similar purposes

Milled from the bar, drilled, faced and key-wayed to specifications. Highly finished, accurate, complete on receipt and ready to attach.

STEEL BALL CRANK  
MACHINE HANDLESCOMPOUND  
REST  
HANDLES

No.	Length Over All	Center Ball	Large End Ball	Small End Ball
0	3	$\frac{3}{8}$	1	$\frac{5}{8}$
1	$3\frac{1}{8}$	1	$1\frac{1}{8}$	$\frac{3}{4}$
$1\frac{1}{2}$	4	$1\frac{1}{8}$	$1\frac{3}{8}$	$\frac{3}{4}$
2	$4\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{3}{8}$	$\frac{3}{4}$
3	5	$1\frac{1}{8}$	$1\frac{3}{8}$	1
4	$5\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{3}{8}$	1
5	6	$1\frac{3}{8}$	$1\frac{3}{8}$	1
6	$6\frac{1}{8}$	$1\frac{3}{8}$	$1\frac{3}{8}$	1
7	7	$1\frac{3}{8}$	$1\frac{3}{8}$	1
8	$7\frac{1}{8}$	$1\frac{3}{8}$	$1\frac{3}{8}$	1
9	8	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{8}$
10	$8\frac{1}{8}$	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{8}$
11	9	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{8}$
12	11	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{8}$
13	13	$1\frac{1}{2}$	2	$1\frac{1}{4}$

Center ball can be drilled and faced any size desired.

## MACHINE HANDLES



No.	Length of Shank	Length Over All	Diameter of Shank
000	$\frac{1}{2}$	1	$\frac{1}{4}$
00	$\frac{1}{2}$	2	$\frac{1}{4}$
0	$\frac{1}{2}$	$2\frac{1}{4}$	$\frac{1}{4}$
1	$\frac{3}{4}$	$2\frac{1}{2}$	$\frac{1}{4}$
2	$\frac{3}{4}$	$3\frac{1}{2}$	$\frac{1}{4}$
3	$\frac{3}{4}$	$3\frac{1}{2}$	$\frac{1}{4}$
4	$\frac{3}{4}$	4	$\frac{1}{4}$
5	$\frac{3}{4}$	$4\frac{3}{8}$	$\frac{1}{4}$
6	1	$4\frac{3}{8}$	$\frac{1}{4}$
7	1	$5\frac{3}{8}$	$\frac{1}{4}$
8	$1\frac{1}{4}$	5	$\frac{3}{8}$

No.	Length Over All	Center Ball	End Balls	
1	$2\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	No handle in ends
2	$2\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in one end
3	$2\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in both ends
4	3	$1\frac{1}{8}$	$\frac{3}{4}$	No handle in ends
5	3	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in one end
6	3	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in both ends
7	$3\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	No handle in ends
8	$3\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in one end
9	$3\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in both ends
10	4	$1\frac{1}{8}$	$\frac{3}{4}$	No handle in ends
11	4	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in one end
12	4	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in both ends

Center ball can be drilled and faced any size desired.

## TWO BALL LEVERS

Adapted for Tail Stock, Tighteners, Drill Press Clamps, Back Gear Levers, and for all similar purposes.



No.	Length Over All	Large End Ball	Small End Ball
2	$4\frac{1}{4}$	$1\frac{1}{4}$	$\frac{3}{4}$
4	$5\frac{1}{4}$	$1\frac{1}{4}$	1
6	$6\frac{1}{4}$	$1\frac{1}{4}$	1
8	$7\frac{1}{4}$	$1\frac{1}{4}$	1
10	$8\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$
11	9	$1\frac{1}{4}$	$1\frac{1}{4}$

Large ball can be drilled and faced any size desired.

Manufactured as a specialty and sold below the manufacturing cost of cast iron or forged handles.

# THE ALLEN MANUFACTURING CO.

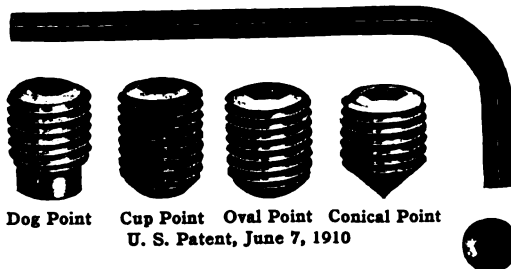
135 SHELDON ST., HARTFORD, CONN.

Manufacturers of Safety Set Screws, Socket Head Cap Screws, Tap Extensions



## SAFETY SET SCREWS

Allen Safety Set Screws are made in every diameter, every length and every shaped point for any purpose to which a safety set screw can be put. The diameters range from  $\frac{1}{4}$  inch up to  $1\frac{1}{2}$  inches.



Dog Point    Cup Point    Oval Point    Conical Point  
U. S. Patent, June 7, 1910

All "Allen" Screws are made by a Patent Process which produces a clean socket and adds 30% more strength to the screw. *Write for Circular.*

**We make a specialty of Short Length Screws:** With our process of manufacture we can make Safety Set Screws much shorter than the diameter of the screws. The entire length of screw is utilized either for solid metal at the point or depth of socket for the wrench. No waste space filled with chips as in broached screws.



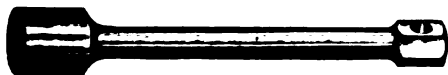
## ALLEN SOCKET HEAD CAP SCREWS

"ALLEN" Socket Head Cap Screws are made on new principles. You can set them up as hard as you want, as often as you want, and be sure that when you desire to loosen them you can do so without marring the head in the least. They are accurately threaded to standard gauges and are perfect in lead. The heads are perfectly true with the body of screw, and, unlike the usual run of round slotted cap screws, you do not have to grind off one side of screw to fit counterbore.



## TAP EXTENSIONS

The Allen Tap Extension is a new shop tool designed to make more effective the use of the ordinary commercial tap by saving the expense of having special taps with long shanks. They are manufactured in sets of three pieces, 2", 4" and 6" long. The shortest extension adds  $1\frac{1}{2}$ " to the effective length of shank, while the three in combination give 6 different lengths ranging up to 11 inches. This must appeal to every user of taps.



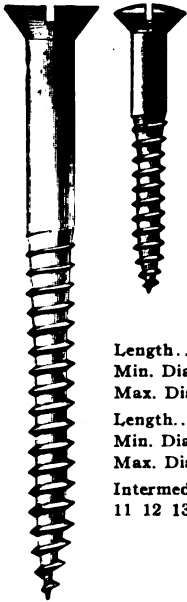
**SOCKET WRENCHES**  
With and without handles

# AMERICAN SCREW COMPANY

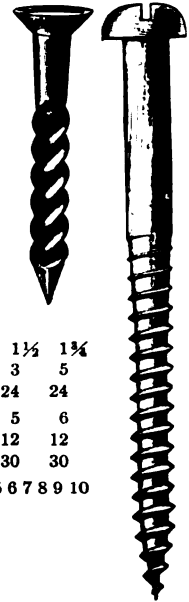
PROVIDENCE, R. I.

Makers of Wood Screws, Machine Screws, Stove Bolts, Tire Bolts, Rivets, etc.

Flat Head Oval Head



Drive Screw Round Head



## WOOD SCREWS

Flat and Round Head Wood Screws are regularly made in Iron in the following sizes, and in Brass in sizes of approximately the same variety; other kinds of Wood Screws are made in the sizes commonly used.

Length.....	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$
Min. Dia....	0	0	1	1	2	2	3	3	3	5
Max. Dia....	4	9	12	14	16	16	20	24	24	24
Length.....	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{2}$	4	$4\frac{1}{4}$	5	6
Min. Dia....	5	5	5	6	6	8	8	12	12	12
Max. Dia....	24	24	24	24	26	26	30	30	30	30

Intermediate diameters advance as follows: No. 0 1 2 3 4 5 6 7 8 9 10  
11 12 13 14 15 16 17 18 20 22 24 26 28 30

## MACHINE SCREWS

Flat, Round, and Fillister Head Machine Screws are regularly made in Iron in the following sizes, and in Brass in sizes of approximately the same variety:

Length...	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$1\frac{1}{4}$	1	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{2}$
Min. Dia.	2	2	2	2	2	2	2	2	4	4	4	4	4	4
Max. Dia.	10	14	16	24	24	24	24	24	34	34	34	34	34	34
Length...	$1\frac{1}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{3}{4}$	4				
Min. Dia.	4	4	5	7	7	7	9	9	4	4				
Max. Dia.	34	34	34	34	30	30	30	30	30	30				

Intermediate diameters advance as follows: No. 2 3 4 5 6 7 8 9 10 12 14 16 18 20 24 30 34

Flat Head



Round Head



Fillister Head

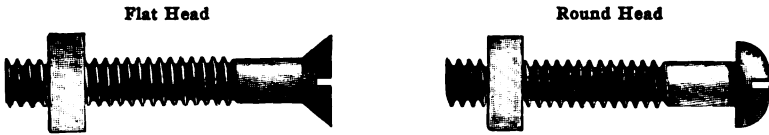


Diameter No.	2	3	4.5	6	7	8	9.10	12	14
Threads per in.	48.56.64	48.56	32.36.40	30.32.36	30.32	30.32.36	24.30.32	20.24	18.20.24
	16.18	20	24	30	34				
	16.18.20	16.18	14.16.18	14.16	13				

Regular Side Knob Screws  are  $\frac{1}{8}$  inch No. 9, 24 thread.

# AMERICAN SCREW COMPANY

## STOVE BOLTS



Flat and Round Head Iron Stove Bolts are regularly made in the following sizes:

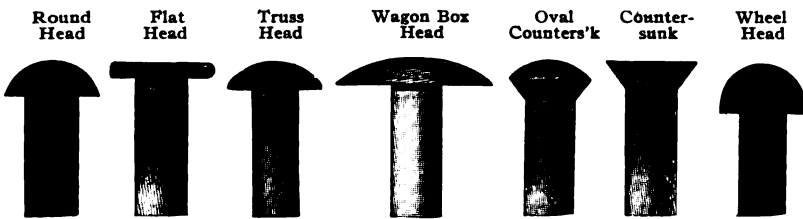
Diameter.....	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$1\frac{1}{2}$
Min. Length.....	$2\frac{3}{8}$	$2\frac{7}{8}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{4}$	$6\frac{1}{2}$	$1\frac{1}{2}$
Max. Length.....	2	2	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{4}$	$6\frac{1}{2}$	3

The length advances by eighths of an inch from  $\frac{3}{8}$  to  $\frac{1}{2}$ , then by quarters to  $6\frac{1}{4}$ .

## STOVE RODS

Stove Rods are the same as Stove Bolts in every respect excepting length. They are regularly made in Iron of  $\frac{1}{8}$  and  $\frac{1}{4}$  diameter in length from 7 to 40", advancing by halves of an inch.

## RIVETS



Cold-headed Rivets are made in great variety of styles and sizes up to  $\frac{1}{8}$  in. diameter and 6 in. length.

## MEASUREMENTS

The length includes the head of Flat Head Screws, Stove Bolts, and Stove Rods; excludes the head of Round and Fillister Head Machine Screws and Round Head Stove Bolts and Stove Rods; includes the countersink of Oval Head Screws and about half the head of Round Head Wood Screws, but the practice with regard to Round Head Wood Screws is not uniform with all makers.

The length of Rivets is exclusive of the head for all styles with a right angle under the head, and inclusive of the countersink for countersunk heads.

The diameter of Screws is measured by the American Screw Gauge, the equivalent in inches being:

0	.0578	5	.1236	10	.1894	15	.2552	22	.3474
1	.0710	6	.1368	11	.2026	16	.2684	24	.3737
2	.0842	7	.1500	12	.2158	17	.2816	26	.4000
3	.0973	8	.1631	13	.2289	18	.2947	28	.4263
4	.1105	9	.1763	14	.2421	20	.3210	20	.4526
								34	.5053

The diameter of Rivets is measured by the old Standard Birmingham Wire Gauge, the equivalent in inches being:

000	.425	2	.284	6	.203	10	.134	14	.083
00	.380	3	.259	7	.180	11	.120	15	.072
0	.340	4	.238	8	.165	12	.109	16	.065
1	.300	5	.220	9	.148	13	.095	17	.058
								18	.049

## THE CINCINNATI SCREW CO.

TWIGHTTWE, OHIO

(Cincinnati Suburb)

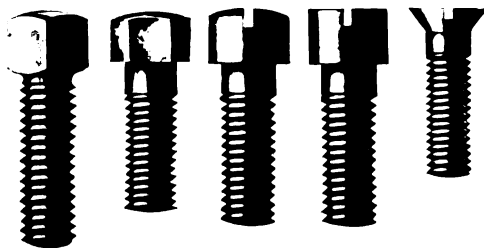
Screw Machine Products, Standard Set and Cap Screws

### ANY PART TURNED FROM BAR

We are fully equipped to make from specifications a large variety of parts used on automobiles, aeroplanes, steamships, carburetors, electrical apparatus, telephones, firearms, lubricators, bicycles and motorcycles, spark plugs, type-writers, phonographs, machine tools, gas and steam engines, automobile accessories, Ford parts for jobbers, such as cones, rollers, cylinder bolts, plain and castellated nuts; also manufacture a full line of standard set and cap screws, all milled from solid bar.

We are splendidly equipped to make any part from any metal up to four inches in diameter.

Only a special cold drawn steel screw stock, which has proven uniform for threading and forming, is used; this high quality of stock runs true to size and gives better wearing qualities to the screws.



### SET AND CAP SCREWS

Milled from solid steel bar

**Set Screws:** Diameters of screw range from  $\frac{1}{4}$  to  $1\frac{1}{4}$  inches and length under Head to Extreme Point from  $\frac{1}{2}$  to 5 inches. Staple sizes usually carried in stock.

**Square Head Cap Screws** are made to order only.

**Hexagon Head Cap Screws:** Staple sizes usually carried in stock.

**Round and Filister Head Cap Screws:** Staple sizes usually carried in stock.

**Flat and Button Head Cap Screws:** Made to order only.

### MACHINE HANDLES

Turned from Steel Bar

Machine Handles, compound rest and ball crank handles—for Machine Tools, etc., finished ready for use. Standard and special sizes.

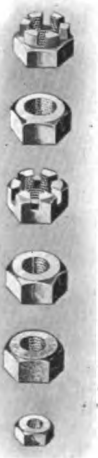


**NUTS:** Milled S. A. E. and A. L. A. M. Standard Castellated Nuts, carried in stock, Soft and Case Hardened. Milled S. A. E. and A. L. A. M. Standard Plain Nuts, carried in stock. Semi-finished Nuts, Castellated, and U. S. Standard Threads. Semi-finished Nuts, U. S. S. Threads furnished from stock. Special designed nuts.

**Miscellaneous Special Small Parts:** We make the small parts, especially in diameters from  $\frac{1}{16}$  to  $\frac{1}{4}$  inch, used so extensively in electrical instruments, clocks, cameras, automobile self-starters, carburetors, magnetos, cash registers, sewing machines, talking machines, and many other articles where close limits are required.

We would esteem it a privilege to submit estimates on your specifications, from samples or blue prints, for any part named.

*Our catalogue furnished upon application.*





# **SAMUEL J. SHIMER & SONS**

**Established 1868**

**MILTON, PA.**

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## **SCREWS**



*Iron Set Screws*

*Square and Hexagon Head*

*Round and Filister Head*

*Cap Screws*

*Cap Screws*

*Button Head*

*Flat Head Cap Screws*

*Cap Screws*

**319**

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**From Stock or made promptly to order in lots of 100 or more**

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**Send us your specifications for prices**

# THE CHAMPION RIVET CO.

Established 1895

CLEVELAND, OHIO

Manufacturers of Boiler, Ship, Structural and Tank Rivets

## VICTOR STEEL RIVETS

The Champion Rivet Company invites the closest inspection of the quality of Open Hearth Steel used in the manufacture of Victor Rivets, and we have given in our catalog fac-simile of chemists' reports and tests from laboratories of the highest standing.

Open Hearth Steel fulfills every requirement for a rivet steel. This is amply proved by the use of Victor Rivets in the most important works, and by the numerous tests which we offer in our catalog.

### ACTUAL RESULTS OF TESTS

Showing the Physical Qualities of Victor Steel Rivets

Sample Mark	Diam. of Bar in inches	Elastic Limit in pounds per sq. in.	Ultimate Tensile Strength in pounds per sq. in.	Elongation in 8 ins., per cent	Reduction of Area, per cent	Character of Fracture
Steel Rivet Bar No. 1.	1.100	38210	49840	35.	61.7	Silky
" " " " 2.	1.100	37650	50880	35.	62.3	"
" " " " 3.	.895	32430	46735	31.2	62.9	"
" " " " 4.	.985	33532	54320	33.7	66.5	"
" " " " 5.	.735	37720	55070	33.7	66.5	"
" " " " 6.	.605	43150	53540	29.5	66.6	"
" " " " 7.	.480	40630	50030	32.5	62.2	"
" " " " 8.	.675	34090	51710	28.	64.9	"
" " " " 9.	.670	33760	53190	30.7	72.7	"
" " " " 10.	.855	31350	50340	30.	67.1	"
Steel Rivet No. 1.	.855	33710	55380	....	65.8	"
" " " 2.	.855	35220	55300	....	67.8	"



Standard Heads of Large Rivets

Standard Heads for Small Rivets made in Cone, Button, Tank Pan, Flat Countersunk, Oval Countersunk, Flat and Wagon Box types. We are now making Sheet Iron Rivets of this type, smaller than  $\frac{1}{2}$ " diameter. We are also prepared to make these small rivets with special heads of all kinds.

Standard Heads of Large Rivets made in Cone, Button, Steeple, Flat Countersunk, Pan Head Swell Neck, Pan Head Straight Neck, Oval Countersunk, Flat Head types. Special types, heads, etc., can be made to meet the requirements or ideas of any consumer as might be outlined.

Victor Boiler Rivets conform strictly to the Standard Specifications for Boiler Rivet Steel adopted by the American Society for Testing Materials, both as regard physical and chemical tests.

The fourth edition of our book, "Scientific Facts and Other Valuable Information Relative to Victor Boiler, Structural Ship and Tank Rivets," contains more valuable, scientific and original information than has been published in book form—yours for the asking.



## DIAMOND EXPANSION BOLT CO.

90 WEST ST., COR. CEDAR, NEW YORK

FACTORY: GARWOOD, N. J.

Manufacturers of "Diamond Specialties:" Expansion Bolts and Anchors, Drills, Cable and Pipe Clamps, Conduit Rods, etc.

### DIAMOND EXPANSION BOLTS



Patented  
"Diamond X" Lag Screw Expansion Shield

"DIAMOND X" LAG SCREW  
EXPANSION SHIELD: A single  
unit malleable lag screw shield  
for heavy duty. Enormous dis-  
placement of metal at inner end  
creating great holding capacity.



"Diamond N" Screw Anchors—  
Patented



"Diamond N" Expansion Shields—Patented

"DIAMOND N" TWO PART SHIELDS AND SCREW ANCHORS are used with a standard lag screw and wood screw threads.

For attaching light and heavy equipment to brick, stone or concrete walls.



DIAMOND  
REVERSIBLE  
TOGGLE BOLTS

For attaching to hollow tile Stucco and all kinds of metal Lath Walls. Toggles may be used with either the head or nut of stove bolt exposed.

### DIAMOND "RAPID FIRE" DRILL

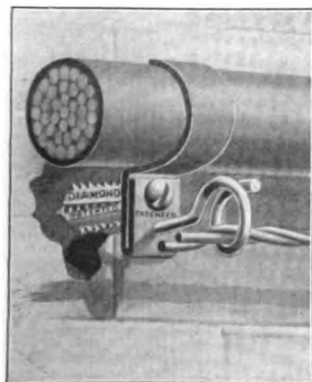
Reduces cost of drilling hole in brick, stone and concrete. Strikes eight sharp blows with each turn of the crank. Points are interchangeable for all sizes of holes.



"Rapid Fire" Drill



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"Long-Saut" Clamps

### "LONG-SAUT" CABLE AND PIPE CLAMPS

Used for attaching lead cable and parallel runs of bridge wire in interior block distribution.

This form of telephone construction is now being employed in all modern telephone plants.

"Long-Saut" Clamps are made to conform to every diameter of cable and may be used with or without bridge rings, as conditions require. Attached with Diamond Screw Anchors to brick, stone or concrete or with wood screws to wooden structures.

EMPIRE CONDUIT RODS  
Patented No. 911,854, Feb. 9, 1909.



With or without Wheels  
Made of best quality Hickory with quick-acting Automatic Couplings.

# THE MILTON MANUFACTURING CO.

MILTON, PENNA.

**Manufacturers of Cold Punched and Hot Pressed Nuts, Wrought Washers, Refined Bar Iron**

## "MILTON" NUTS

Cold Punched Chamfered Square or Hexagon—Plain Square or Hexagon—Hot Pressed Square or Hexagon (Blank with drilled holes or tapped to Pratt & Whitney Standard)—Semi-finished—Finished, Finished Case Hardened, Slotted and Castle.



From the purchase of the raw materials until the finished product is ready for shipment, the manufacture of "Milton" Nuts is under the constant supervision of men who know, theoretically as well as practically, thus assuring the purchaser of receiving an absolutely uniform Nut, rendering a superlative degree of Efficiency at all times.



Many builders of the most intricate machinery are specifying "Milton" Nuts exclusively, owing to their accuracy, which admits of rigid construction and prevents vibration, at the same time adding mechanical refinement to their machines.



We have faith that, knowing our materials and their uses by technical and practical knowledge, we can meet in our line the highest scientific requirements.



# **RUSSELL, BURDSALL AND WARD BOLT AND NUT COMPANY**

PORT CHESTER, N. Y.

ROCK FALLS, ILL.

**Manufacturers of All Kinds of Bolts, Nuts and Rivets**



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## **"EMPIRE" BOLTS AND NUTS**

**Carriage Bolts  
Machine Bolts  
Coupling Bolts  
Stud Bolts  
Tap Bolts  
Plow and Cultivator  
Bolts**

**Stove Bolts  
Tire Bolts  
Rivets and Special Bolts  
of all descriptions  
Cold Punched, Chamfered  
and Trimmed Hexagon  
and Square Nuts**

**A.L.A.M. Plain and Cast-  
telled Nuts  
Master Mechanics' Cast-  
tle Nuts  
Semi-finished, Full Fin-  
ished and Case Hard-  
ened Nuts**

**Our Trade Mark:  
"EMPIRE"**

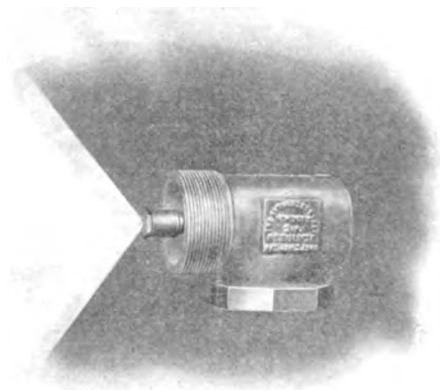
**signifies a certain standard of excellence that invites your investigation.**

## **THE ANTHONY COMPANY**

138 WEST AVENUE, LONG ISLAND CITY, N. Y.

**Liquid Fuel Engineers**

**Oil  
Is the  
Fuel  
of the  
Future**



**Consult  
Us**

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**Mechanical Atomization—A Perfect Mist of Oil**

### **ANTHONY NEBULYTE OIL BURNERS**

Low and High Pressure Designs to Suit Every Requirement.

A Trial Proves Their Unequalled Operating Characteristics.

### **ANTHONY OIL CRUCIBLE FURNACES**

Large Output, Low Operating Cost, Long Crucible Life, Durable Linings.

Soft Flame, Small Shrinkage, Non-oxidized Metal.

### **ANTHONY OIL RIVET FURNACES**

Compact, Portable, Economical, the Equal of Four Coal Forges.

### **ANTHONY OIL BURNING EQUIPMENT**

For Annealing, Tempering, Hardening, Forging, Melting—All Purposes.

Designs Furnished at Reasonable Cost.

### **ANTHONY OIL BURNING SYSTEMS**

For Industrial Heating Processes.

For House Heating Uses.

### **ANTHONY NEBULYTE OIL SPRAYS**

For Water-Gas Machines.

Perfect Atomization, Positive Control, Uniform Distribution of Oil.

**ANTHONY NEBULYTE SPRAYS** of definite capacity and throw can be utilized to advantage for many purposes—cooling, aerating, atomizing, gasifying, mixing, distributing liquids over large areas, etc.

## W. N. BEST, INC.

11 BROADWAY, NEW YORK

**Engineers in Caloric: Liquid Fuel Equipment; Furnaces for Heating, Melting and Heat Treatment of Metals. High Pressure, Low Pressure, Volume Air, Air Carburetting and Mechanical Burners of All Sizes**

### W. N. BEST CALOREX LIQUID FUEL FURNACES AND EQUIPMENT

*Twenty-seven Years' Experience in Handling Liquid Fuel. All Installations Guaranteed.*

Designs for changing coal-fired furnaces to oil-fired, for the remodeling of existing oil-fired furnaces, and the construction of all forms of furnaces for heating and heat treatment of metals.

If your present liquid fuel equipment is not in every way satisfactory, it can be remodeled to give perfect results. We guarantee entire satisfaction.

To secure 100% economy and 100% efficiency use W. N. Best Oil and Tar Burners for Annealing, Case Hardening, Tempering, Forging, Heat Treating, etc.

#### W. N. Best High Pressure Burner Unmounted

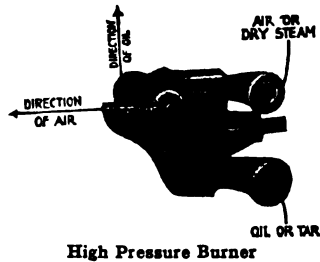
1. Note the direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally, which prevents clogging or carbonizing, the burner always being kept clean.

2. By releasing the set screw in yoke and raising the lip any obstruction that might find its way through the air line can be blown out

3. Air or dry steam from 15 pounds up can be used to atomize the oil.

4. The burner being in form of a syphon requires but very low oil pressure.

5. Burners can be fitted to throw either a long, narrow flame or a fan-shaped flame 9 feet wide, thus doing away with the necessity of using more than one burner in any fire-box or furnace that is 9 feet or less in width.



High Pressure Burner

#### W. N. Best Oil Regulating Cock

This regulating cock is provided with a V-shaped, knife-edged opening in the plug, which not only has a shearing action on heavy liquid fuels, but enables the operator to secure the finest possible adjustment.

When a furnace is working continuously on one class of work this cock can be set by the adjusting screw so that when the burner is stopped, it can be returned to the same adjustment when again started.

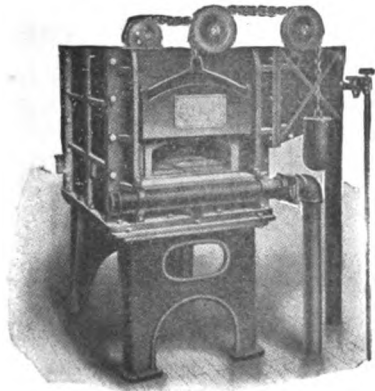


Oil Regulating Cock

#### Class "D" Forge Furnace

Designed especially for drop forge work, but can be used for a wide range of heating, welding, tempering, etc. By placing a muffle in the charging space makes an ideal muffle furnace. Made with one or two charging openings.

The consuming fuel unites with the air necessary for perfect combustion in the combustion chamber before it reaches the charging space of the furnace—there is therefore no oxidation of the metal while being heated. The combustion chamber and arch are of such form and proportions that the flame and heat reverberate perfectly upon charging space of the furnace.



Forge Furnace

**CALOREX**



## GILBERT & BARKER MFG. CO.

Established 1885

SPRINGFIELD, MASS.

NEW YORK, 26 Broadway

Designers and Manufacturers of Fuel-Oil Burning Appliances, Fuel-Gas Machinery, Furnaces, Etc.

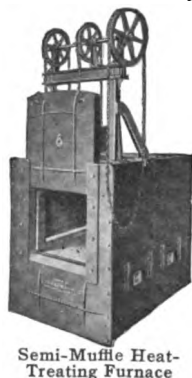
*Fifty years' practical experience*, combined with a thorough knowledge of fuels and combustion, enters into the designing and building of Gilbert & Barker Furnaces. Our furnaces are convenient for the operator, from whom they require little attention—giving a reliable and uniform heat throughout—and burning the fuel in the smallest possible space with complete combustion—they economize in time, labor, up-keep and fuel.

### SEMI-MUFFLE FURNACES

For Case Hardening, Annealing, Carbonizing, Heat Treating, General Hardening and Heating Work.

(Oil or Gas Fuel.)

The Gilbert & Barker Semi-Muffle Furnaces are designed for and accomplish the most exacting work. Complete combustion of the fuel takes place beneath the floor of the heating chamber. The hot gases then pass to the heating chamber through suitable opening so placed that the heat is evenly distributed without a variation of one degree, and the perfect regulation of the flame makes oxidation and overheating impossible. Provision is made for a pyrometer by which the exact degree of heat can be accurately measured. No flue or chimney is required with this type of furnace.



Semi-Muffle Heat-Treating Furnace

### GAS FURNACES

Our line includes End-Heating Furnaces, Forging and Welding Furnaces, Semi-Muffle Furnaces, Muffle Furnaces, Round, Rectangular and Double Pot Furnaces for hardening with lead and cyanide, Round and Rectangular Pot Furnaces for tempering and bluing, Crucible Furnaces, Bench Forges, and Soldering Furnaces.

### BURNING FUEL OIL UNDER LOW PRESSURE

Under the Gilbert & Barker Process, oil is burned with a clean, clear fire, and with complete combustion.



Rectangular Pot Furnace

For hardening, tempering, case hardening, melting, annealing, heating, singeing plates, and all sorts of work requiring a clean, even heat, oil has proved an economical fuel.

The apparatus consists of a specially constructed rotary air compressor, an oil pump, a storage tank, the burners and necessary piping. The oil is brought to the furnace under pressure and enters the furnace in the form of a spray. By our method of applying the burners to a furnace, free air is drawn in around the burner sufficient for complete combustion.

*We shall be pleased to furnish complete information on the equipment of complete heat-treating departments from storage tank to burner, and furnaces.*



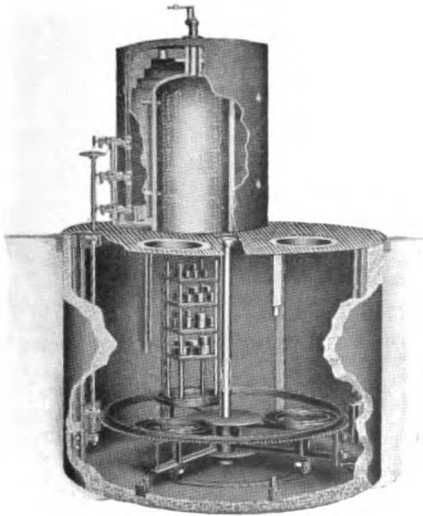
TRADE MARK



# CHARLES F. KENWORTHY

WATERBURY, CONN.

Manufacturers of Industrial Furnaces



Non-Oxidizing Annealing Furnace

## NON-OXIDIZING ANNEALING FURNACES

Vertical and Horizontal Types for  
all Metals (Oil or Gas Fuel)

These furnaces leave the metals  
dead soft, clean, free from oxides  
and scale and smoother than is  
possible by any other annealing  
method, thus saving acid, labor,  
wear on dies, tools, etc.

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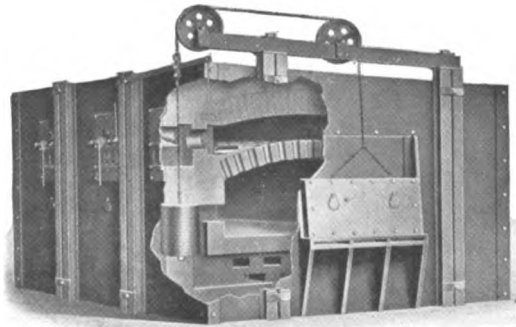
## HEAT TREATING FURNACES

Sizes to meet your needs—either single chamber and single or double  
end—car type hearths if desired.

For all heat treating, annealing and carbonizing operations.

These furnaces give rapid heating and absolute uniformity of temperature.

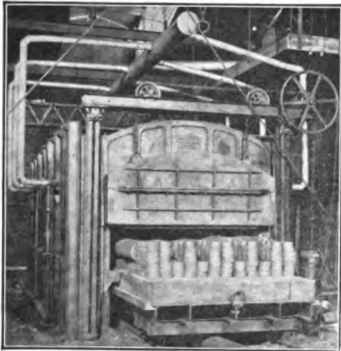
*Descriptive  
Circulars  
may be  
had on  
request*



No. 705 Heat Treating Furnace

# TATE-JONES & CO., INC.

Furnace Engineers  
PITTSBURGH, PENNA.



Car Type Annealing Furnace  
Braeburn Steel Plant, Braeburn, Pa.

## OVERFIRED FURNACES OIL OR GAS FUEL For Heat Treating, Annealing, Carbonizing

Accurate and easily controlled temperatures are absolutely essential in these heating operations. Add to these, ease and economy of operation and a large output of perfect work and you have the distinguishing features of the Tate-Jones Overfired Furnaces.

The combustion chamber is above the heating compartment, the heat being forced downward through a perforated arch of high grade fire brick. The heat is thus evenly distributed and a uniform temperature is accurately controlled by the burners and the dampers and can be maintained indefinitely.

**Accuracy of Temperature:** Specially designed burners (either oil or gas) insure prompt control. The products of combustion and hot gases pass through the perforations in the combustion chamber and into the heating chamber and spread out horizontally onto the work. Pyrometer readings will show every corner uniformly heated.

The desired heat is maintained by a damper system and when properly adjusted controls the temperature with such accuracy that uniform results can be expected from every heat.

The extremely short time of preparation and for the heating process speeds up the output and saves fuel. The roller bearing sheaves and close counterbalancing of the doors and convenient arrangement of all operating parts, save labor. Walls, hearths and arches are made of best grade fire brick with highest refractory qualities, laid with tight joints. Between the inner lining and outer frame is a course of insulating brick—reducing the loss of radiation to the minimum. Heavy cast iron doors—lined with fire brick and insulating brick; always tight when closed.

These furnaces are made in car type and two types of stationary hearth—all fire brick and fire brick with cast iron bars imbedded in the top. In car type, sand seals on car and door prevent heat loss and keep running gear of car cool.

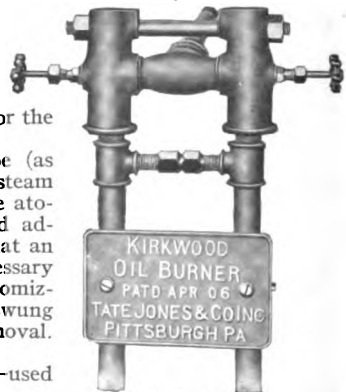
Write for circular 154-A

## OIL BURNING EQUIPMENT FOR OPEN HEARTH FURNACES

Complete equipment of the highest type for the successful and economical burning of oil fuel.

The Kirkwood Oil Burner, swinging type (as illustrated), uses oil and compressed air or steam for atomizing. The ratio between oil and the atomizing agent is scientifically worked out and adjustment made and fixed at the factory so that an efficient fire is always maintained. Necessary valves permit the cutting off of the oil and atomizing agent when necessary. The burner is swung in a holder which permits insertion and removal. Nozzle can be elevated or depressed at will.

We also supply a water-cooled burner—used where swinging type can not be used.

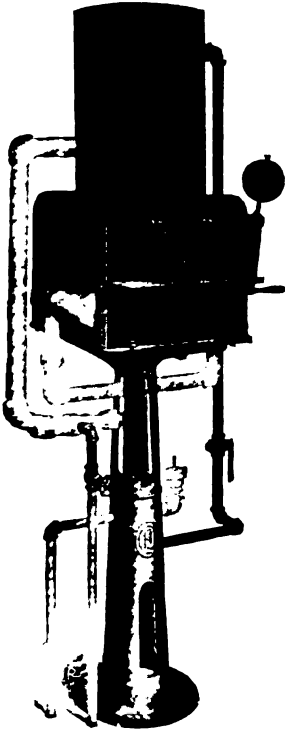


(Swinging Type)

# TATE-JONES & CO., INC.

Furnace Engineers

PITTSBURGH, PENNA.



**Series A.** For Temperatures  
900° to 1600° Fahr.

## IMPROVED RECUPERATIVE GAS OVEN FURNACE

For Accurate Temperature Work  
900° to 1600° Fahr.

Uses Artificial or Natural Gas  
Air Pressure—4 oz. to 2½ Lb.

For hardening carbon steel, preheating or reheating high speed steels. The most scientifically designed line of furnaces and also the most efficient, as actual comparative tests have proven.

The fire brick lining is backed up with 1 inch of special insulating material that is equivalent, in the prevention of heat loss, to 9 inches of fire brick. This effects a big saving in fuel and improves operating conditions.

Because of the design of the interior, 100% of the available radiant and radiated heat is delivered to the work. This is nearly 50% more than other furnaces deliver.

The recuperation device is substantially built and saves fully 25% of the fuel. It is made of cast iron, sheet steel and high grade fire brick. The coil is 1¼" wrought iron pipe, so placed that no direct vent heat strikes it.

*Circular 160-A sent on request.*

## SERIES H FURNACES

For Temperatures 1600° to 2400° Fahr.

Use Artificial or Natural Gas  
With Air at 1½ to 2½ Lbs. Pressure

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The linings are of exceptional quality and efficient, therefore loss by radiation is very small.

The door is built on a slant which tightly engages with the slanting front of the furnace. As the door overlaps top, bottom and sides, and drops into a recess below the shelf level, there is no leakage. Raising the door a fraction of an inch frees it from the front.

Series H Furnaces can be had recuperator type, same as Series A.

*Circular 160-A sent on request.*

## Some Other TATE-JONES Products

Plate and Angle Heating Furnaces, Tool Dressing and Blacksmith Forges, Bolt Heading and Rod Heating Furnaces, Small Forging Furnaces, Heavy and Medium Forging Furnaces, Rivet Forges, Oil Burners for Ceramic Industries, Gas Burners for Furnaces, Lead and Cyanide Pot Furnaces, Tempering Furnaces. Gas or oil burners for boilers. Gas or oil burners for furnaces. Complete oil burning installations.

# W. S. ROCKWELL COMPANY

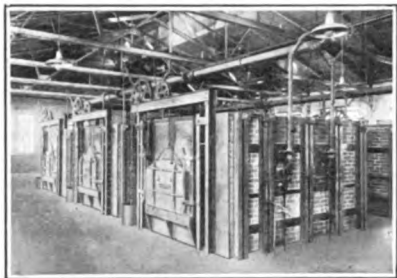
50 CHURCH ST., NEW YORK

(Hudson Terminal Bldg.)

Furnace Engineers and Contractors

## COMPLETE INDUSTRIAL FURNACE EQUIPMENT

OIL—GAS—COAL



Carbonizing and Heat-Treating Furnaces

"FURNACE AND FUEL TO SUIT THE WORK"—is the rule governing our consideration of a new or the improvement of an old furnace equipment to suit your needs under your plant conditions. Our purpose is to deal with each case on its individual merits and to recommend changes in methods or equipment only when it is apparent that these will be productive of better results.

we do not merely sell furnaces, but rather means for efficient production in industrial heating operations, which involves a great deal more than brick and iron or the burning of fuel.

### Let Us Handle Your Furnace Problems

We make inspection of plant, devise methods and means of working, prepare plans, furnish complete industrial furnace equipment and guarantee results, using coal, coke, gas or oil, as the best interests of our patrons require.

The following list of furnaces and appliances illustrates the variety of work we do and our familiarity with furnace and fuel problems:

Annealing Furnaces  
Billet Heating Furnaces  
Blowers  
Carbonizing Furnaces  
Cyanide Furnaces  
Drying Furnaces  
Enameling Furnaces  
Forging Furnaces  
Fuel Oil Appliances

Hardening Furnaces  
Heat-Treating Furnaces  
Heating Furnaces  
Lead Pot Furnaces  
Melting Furnaces  
Muffle Furnaces  
Plate Heating Furnaces  
Rivet Furnaces  
Rivet Rod Furnaces

Spring Fitting Furnaces  
Soft Metal Melting Furnaces  
Stoker Fired Recuperative Furnaces  
Scaling Furnaces  
Tempering Furnaces  
Upsetting Furnaces  
Varnish Boiling Furnaces  
Wire Furnaces

Write for Catalog No. 25



Double-End Plate Heating Furnace



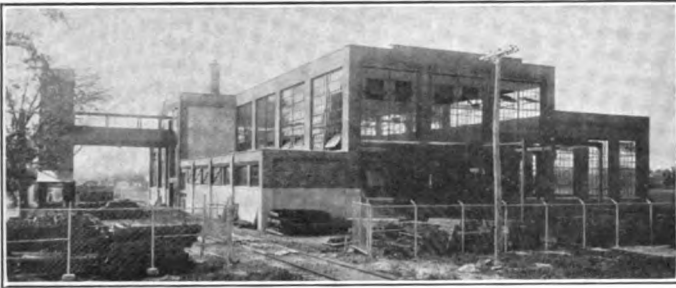
Forge Furnace with Economizer Shield

**THE H. M. LANE COMPANY**  
Foundry Engineers  
**HOLCROFT & LANE COMPANY**  
Contracting Engineers

58 LAFAYETTE BLVD.

DETROIT, MICH.

The H. M. Lane Co. are ready to design your new foundry, or to re-arrange your old plant, so as to increase your output and decrease cost.



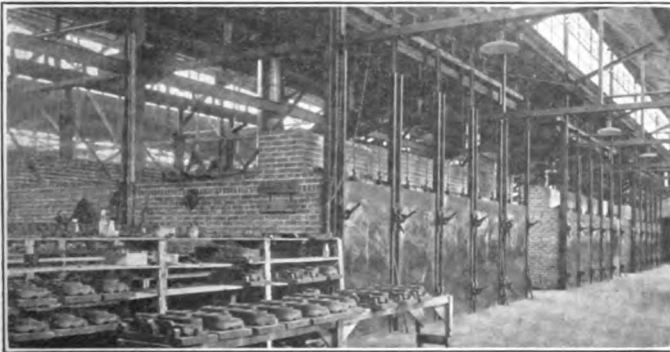
Foundry for Werner & Pfleiderer Co., Saginaw, Mich.

They design special handling appliances, and lay out foundries for all Ferrous or Non-Ferrous metals.

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The Holcroft & Lane Co. build core ovens, mold ovens, annealing ovens, basic and acid open hearth, and all kinds of melting furnaces.

The Lane forced draft ovens give greater drying capacity per cubic foot and more uniform service than other designs heretofore brought out. The rack type oven reduces handling to a minimum, and thus results in decreased cost.



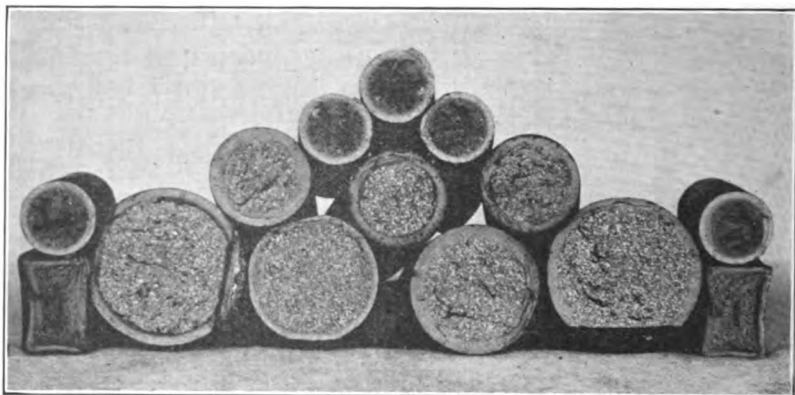
Rack Type Core Ovens for Wilson Foundry & Machine Co., Pontiac, Mich.

**The** Holcroft & Lane Co. have a large force of fire brick masons, and can furnish masons and foreman on short notice.

## AMERICAN METAL TREATMENT CO.

ELIZABETH, N. J.

Case Hardening, Annealing, Hardening, Tempering, Coloring, Etc.



Samples of Case Hardening by the Gas Process

### Our Specialties:

CASE HARDENING

HARDENING

ANNEALING

TEMPERING

GUN METAL COLORING, ETC.



Fractured Ball Race

### We case-harden in bulk parts in the following lines:

Adding Machine Parts

Ball Races

Bushings

Cams

Canning Machine Cams

Gears, Spur Bevel and Worm

Hoisting Engine Parts

Pins and Shafts

Printing Press Parts

Rolls for Various Purposes

Screw Machine Products

Sprockets

Stampings of all kinds

Typewriter Parts

Solid and Hollow Spindles for Screw Machines, Lathes and Grinding Machines, Wrist Pins and Sleeves for Automobile Engines and the largest Stationary Engines.

# CONNECTICUT METAL TREATING COMPANY, INC.

207 KNOWLTON ST., BRIDGEPORT, CONN.

Steel Treating in All Its Branches

---

**HEAT TREATING** for the public is our only business as we are in no way connected with any manufacturing concern. *Prompt and efficient* service to all either on large or small orders.

12 FURNACES handled by *experts* doing the following kinds of work:

## **HIGH SPEED STEEL**

Cutters, taps, lathe tools, tool bits, reamers, dies, planer tools, drills, etc.

## **CARBON or TOOL STEEL**

Any kind of cutting tools, forming tools, punches, dies, bushings and machine parts.

## **PACK HARDENING**

To required depth in machinery or alloy steel.

## **CYANIDING**

Machinery and alloy steel parts requiring a thin hard surface.

## **ANNEALING**

Any steel that heat can soften.

## OXWELD ACETYLENE COMPANY

NEWARK, N. J.

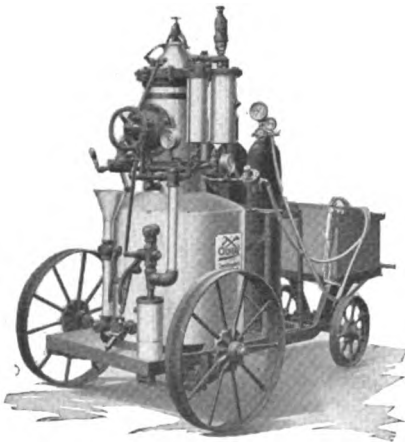
CHICAGO

LOS ANGELES

### OXWELD APPARATUS FOR WELDING & CUTTING METALS

The Oxweld Process of welding and cutting metals by means of the oxy-acetylene flame is so generally employed in the industries that no detailed description need be given.

This Company manufactures and installs under its own direction, apparatus for most efficiently utilizing the process under all conditions; *i. e.*, **Oxweld Low Pressure Generators**, single type, and **Oxweld Low Pressure Duplex Generators**, which consist of two independently operated acetylene generators, of which one may be used while the other is being recharged, **Oxweld Injector Type Welding & Cutting Blowpipes**, with 5 sizes blowpipe handles, and 10 interchangeable welding heads and copper tips, for use with metals of various thicknesses. Being dependent for their efficiency on volume, rather than pressure, Oxweld Injector Type blowpipes (by syphoning action) utilize a far larger proportion of the gas content of a cylinder than do other types of blowpipe. Due to the same principle, they operate with equal efficiency on any gas pressure.



**Portable Pressure  
Generator**

is very extensively used in scrap yards, in gas main construction, in street railroad work, in railroad repair yards and for all other purposes where portability is a consideration. The construction is rugged and substantial throughout. The interlocking control mechanism is automatic and dependable and provides a complete system of interference devices against mistakes in operation. It is made in two sizes, 50 lb. carbide capacity

generating 50 cubic feet of gas per hour, and 100 lb. carbide capacity generating 100 cubic feet of gas per hour (sufficient to operate either 3 or 6 blowpipes, respectively). It may be mounted on a truck or installed in a stationary location. Space is provided on the truck for 3 oxygen cylinders and a tool chest, making the entire equipment self-contained.

For the purposes for which it is adapted, this portable unit furnishes safely and efficiently, on the premises, a continuous supply of acetylene at approximately one-half the cost of gas in cylinders.



# QUASI ARC WELDTRODE CO., INC.

OFFICE AND WORKS: 107 LAFAYETTE ST., NEW YORK

Manufacturers and Importers of Patented Quasi Arc Weldtrodes, Resistances and Static Transformers for Electric Welding, also all Electric Welding Accessories

**THE QUASI ARC SYSTEM** of electric welding represents an important advance over the older methods of autogenous welding, such as oxyacetylene (or other gas), carbon arc, bare wire or electric pencil. Its principal advantages are:

**Positive Fusion**, as shown by microscopic analysis.

**Ductility**, as established by numerous tests in pulling, bending, machining and caulking.

**Great Strength**, as shown by Official Tests (see chart below).

**Metallic Purity**, preserved by the acid slag which covers the fused metal and entirely prevents oxidation or carbonization; and also by purifying agents automatically introduced into the molten metal.

**Increased Speed**, secured by the elimination of the long arc, and by the use of the special coated welding-rod which can (because of its electrical insulation) be connected to the positive terminal of the circuit—which contains over 60% of heat produced.

**Inexpensive Apparatus** only required. The System can be successfully used with either direct or alternating current at 110 volts or over, controlled by a simple rheostat or static welding transformer. Less amperage consumed than by any other electric welding process.

**Weldtrodes** of various sizes always in stock for welding (or building up) steel castings, steel plate, high carbon steel, manganese steel, copper, etc.



The Quasi Arc

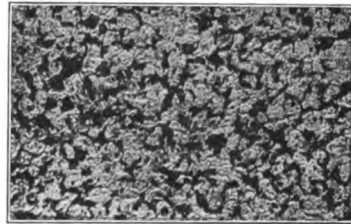


Photo-micrograph (250 diameters) of a Quasi Arc weld. Note the pearlitic structure and fine grain of metal

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## U. S. DEPARTMENT OF COMMERCE AND LABOR

Steamboat Inspection Service

**TENSILE TESTS** of samples of material intended to be employed in the repairs of Boilers of Steam Vessels by Electric Process

Samples welded by Quasi Arc Weldtrode Co. of New York

Numbers on plates	1	2	3	4
Thickness of samples, decimals inch.....	0.494	0.494	0.743	0.521
Width of samples, decimals inch.....	1.00	0.991	1.00	1.023
Strain at which each sample parted.....	28,000	27,500	42,120	31,890
Strain per square inch of section in lbs.....	56,689	56,530	56,680	59,840
Reduced thickness of sample.....	0.685	0.660	0.948	0.852
Reduced width of sample.....	0.282	0.300	0.725	0.419
Reduction of area per cent.....	60.9%	59.5%	7.6%	33.0%
Length of straight part in center of test piece.....	8"	8"	8"	8"
Elongation, percentage.....	29.6%	25%	7.0%	14.0%

Sample No. 1 is the original steel of about 56,000 lbs. tensile strength.

Sample No. 2 is a plate cut in half, welded, and machined flush before pulling. Broke 2 1/4" outside the weld.

Sample No. 3 is a plate cut in two, welded, and re-enforced by deposited metal 1/4" thick down the entire length of one side. Broke in the weld.

Sample No. 4 is a solid plate re-enforced the entire length on one side, and the welded metal then entirely machined off, leaving the plate the original thickness. This test establishes the fact that the original metal is not damaged by the heat of welding.

*Descriptive Booklet and complete information supplied on request.*

# INTERNATIONAL OXYGEN CO.

115 BROADWAY, NEW YORK, U. S. A.

WORKS AT

COLLEGE POINT, N. Y.

NEWARK, N. J.

VERONA, PA.

**Manufacturers of:** Electrolytic Oxygen and Hydrogen Generators; Pure Oxygen and Hydrogen; Pressure Regulating and Reducing Valves for Oxygen, Hydrogen and Acetylene; Stud Valves for Gas Cylinders; Oxygen and Hydrogen Testing Apparatus. Complete Oxyhydrogen Plants Designed, Equipped and Installed; Free Advisory Service on all Applications of Oxygen and Hydrogen

---

Recent improvements in I. O. C. **ELECTROLYTIC OXYGEN-HYDROGEN GENERATORS** permit the production of pure gases with greater economy than was ever before possible. I. O. C. Generators enable a manufacturer to produce gases at a saving of more than 60 per cent as compared with the cost of gas purchased in cylinders.

**COMPACTNESS:** The **Type 1000 Unit Cell** is only  $3\frac{1}{2}$  inches wide. One hundred of these cells, operating at 1000 amperes and producing 20000 cu. ft. of oxygen and 40000 cu. ft. of hydrogen per 24-hour day, occupy a space only  $30 \times 3\frac{1}{2}$  feet, 6 feet in height.

**PURITY:** The **Type 1000 Unit Cell** is guaranteed to produce oxygen 99 per cent pure or better, and hydrogen 99.5 per cent pure or better. This means safety and maximum efficiency in application.

**FLEXIBILITY:** The **Type 1000 Unit Cell** operates on any current from less than 200 amperes to upward of 1000 amperes, giving a production range of more than 5 to 1. The production rate per cell may be as high as 4.4 cu. ft. of oxygen and 8.8 cu. ft. of hydrogen per kilowatt hour.

**ECONOMY:** With all cost factors included—first cost, installation cost, operating and up-keep cost, and power cost—the **Type 1000 Unit Cell** produces purer gases at less cost than any other generator. Repair and replacement costs are negligible.

**I. O. C. SERVICE:** The experience and facilities of the Company, and the advice and assistance of the Company's engineers, are freely at the service of all parties interested in the efficient application of gases for any purpose.

**LITERATURE:** Descriptive literature on the Company's products will be sent on request.



**CATALOGUE SECTION**  
**PART V**

**Compressors, Fans, Blowers**  
**Pumping and Hydraulic Machinery**  
**Drying and Crushing Machinery**  
**Engineering Miscellany**

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**Pages 338-392**

## INGERSOLL-RAND COMPANY

11 BROADWAY, NEW YORK, U. S. A.

Offices in All Principal Cities of the World

Builders of Air and Gas Compressors, Blowers, Pneumatic Hammers, Pneumatic Drills, Air Motor Hoists, Air Motors, Pneumatic Sand Rammers, Air Lift Pumps, Air Power Machinery of All Kinds, Vacuum Pumps, Condensers

### PRINCIPAL PRODUCTS

AIR COMPRESSORS	HOISTS, PORTABLE
AIR HOISTS	JACKHAMER DRILLS
AIR LIFT PUMPING SYSTEMS	PNEUMATIC TOOLS
AIR DRILLS	PORTABLE AIR COMPRESSORS
CAMERON PUMPS	RIVETING HAMMERS
CORE DRILLS	RIVET FORGES
CENTRIFUGAL PUMPS	ROCK DRILLS
CHANNELERS	STEAM PUMPS
CHIPPING HAMMERS	SAND RAMMERS
COAL PUNCHERS	STONE CHANNELERS
COAL SHEARING MACHINES	STONE TOOLS
CONDENSING PLANTS	SUBMARINE DRILLS
CUPOLA BLOWERS	TIE PEELING OUTFITS
DRILL STEEL	TIE TAMPING OUTFITS
DRILL SHARPENERS	TURBO BLOWERS
ELECTRIC-AIR ROCK DRILLS	TURBO COMPRESSORS
GAS COMPRESSORS	TURBO EXHAUSTERS
HAMMER DRILLS	VACUUM PUMPS
HOISTS, PNEUMATIC	WAGON DRILLS

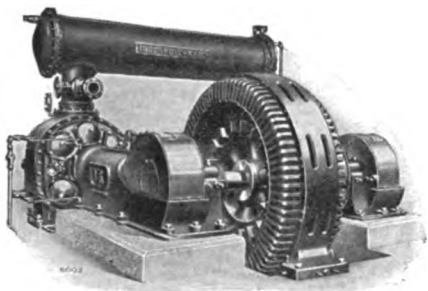
### Known by the Following Trade Names

"BUTTERFLY" ROCK DRILLS	"JACKHAMER" ROCK DRILLS
"BEYER" BAROMETRIC CONDENSERS	"JACKSTOPER" ROCK DRILLS
"CALYX" CORE DRILLS	"LEYNER-INGERSOLL" ROCK DRILLS
"CAMERON" PUMPS	"LEYNER" DRILL SHARPENERS
"CROWN" PNEUMATIC TOOLS	"LEYNER" OIL FURNACES
"ELECTRIC-AIR" ROCK DRILLS	"LITTLE DAVID" PNEUMATIC TOOLS
"GASOLINE-AIR" ROCK DRILLS	"LITTLE TUGGER" PORTABLE HOISTS
"I-R" DRILL STEEL	"RADIALAXE" COAL CUTTERS
"IMPERIAL" PNEUMATIC TOOLS	"STOPEHAMER" ROCK DRILLS
"IMPERIAL" AIR COMPRESSORS AND VACUUM PUMPS	
"INGERSOLL - ROGLER" AIR COMPRESSORS AND VACUUM PUMPS	

*Catalogues covering any of these products furnished upon request.*

## INGERSOLL-RAND COMPANY

### "INGERSOLL-ROGLER" AND "IMPERIAL" AIR COMPRESSORS



"Ingersoll-Rogler" Class "PRR"

The company builds types of compressors for every service, for all pressures to 2500 pounds and in all capacities to 10,000 cu. ft. per minute.

■ These machines are characterized by simplicity of design, reliability, efficiency and silence of operation. All are automatically lubricated, thoroughly water jacketed and compound machines are provided with effective intercoolers.

Compressors are to be had for belt, rope, gear or silent chain drive or may be had as short belt or direct-connected electric motor, balanced piston valve or Corliss valve steam engine driven.

*Bulletins describing any or all types gladly furnished.*

### "INGERSOLL-ROGLER" AND "IMPERIAL" DRY VACUUM PUMPS

Embody the same desirable features of design as the air compressor line. They are high speed machines of large capacity per unit of floor space. They will maintain any desired degree of vacuum within .5 in. of barometer, consistently and at low cost.

*Bulletins 3037 and 3038.*

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### I-R TURBO BLOWERS AND COMPRESSORS

Are built for blast furnace, converter, cupola and similar low pressure service and for all industrial high pressure requirements. Blower capacities from 3000 to 60,000 cu. ft. Compressor capacities from 3500 to 12,000 cu. ft. Pressures from 1 to 100 lbs.

*Full information on request.*

### I-R STEAM CONDENSING PLANTS

of the Beyer Barometric type are to be had for all service conditions. They are highly efficient and very economical to operate.

*Bulletin 9024.*

## THE GARDNER GOVERNOR CO.

QUINCY, ILLINOIS, U. S. A.

### BRANCH OFFICES

NEW YORK CITY

302 Singer Bldg.

RIX COMPRESSED AIR & DRILL CO.

LOS ANGELES, 409 E. 3rd Street

T. T. Burchfield Co.

PHILADELPHIA, 604 Arch St.

CHICAGO 1702 Fisher Bldg.

RIX COMPRESSED AIR & DRILL CO.

SAN FRANCISCO, 505 Howard Street

**Builders of Duplex Steam and Power Pumps; Vertical and Horizontal Air Compressors; Engine Governors and Steam and Oil Separators**

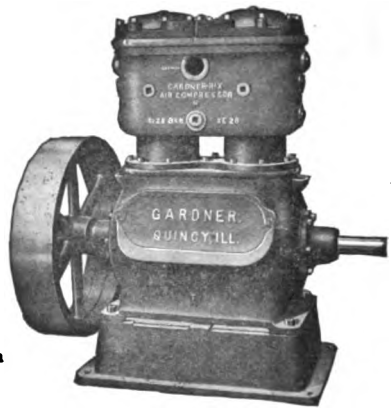
### GARDNER POWER PUMPS AND AIR COMPRESSORS



**CLASS "PMA" The Gardner Packed Piston Power Pump with Double Reduction Gear and Motor Attached on Top of Frame**

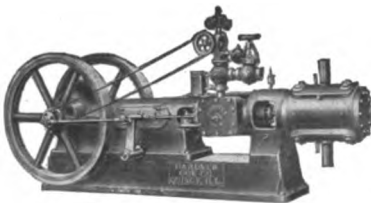
Made in variety of sizes and styles.

Makes a very desirable unit, compact, requiring small floor space, and dispensing with the necessity of the expensive base plate. This is our standard method of motor connection where the size of motor permits of it being mounted on top.



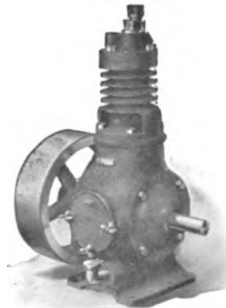
**Duplex High Speed Vertical Compressor**

Also made in single cylinder type, sizes up to 140 ft. capacity.



**Straight Line Horizontal Steam Driven Compressor**

Made in belt and gear driven types, Single and Duplex and two stage type.



**Air Cooled Enclosed Splash Type Compressor**

Capacities to 21 ft.

# THE NORWALK IRON WORKS CO.

SO. NORWALK, CONN.

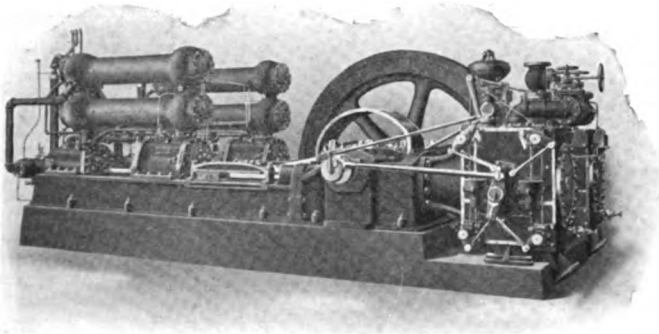
**Builders of Air and Gas Compressors for All Classes of Service**

## NORWALK AIR AND GAS COMPRESSORS

Single- and Multi-stage Compressors, steam, belt, or motor driven.

A standard line of Single- and Two-stage Compressors for general shop use.

Automatic Proportional Unloaders, which regulate the air delivery to suit the demand.

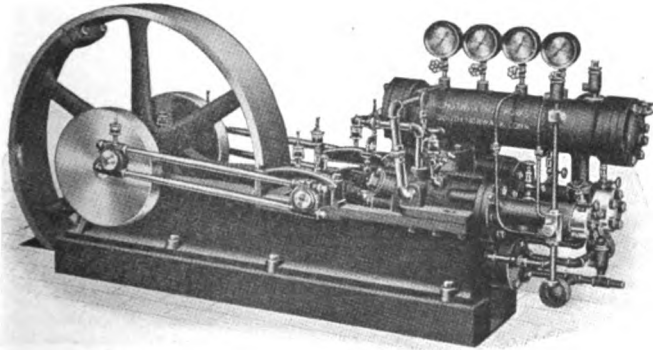


341

**Three-stage, TWIN-DUPLEX Compressor with Simple Corliss Steam Cylinders,  
Suitable for Compressing Air or Gas up to 2000 Lbs. Pressure**

We build a standard line of Three- and Four-stage Compressors, steam, belt, or motor driven, for compressing air or any of the commercial gases up to 7500 pounds per square inch.

The cut below shows a small Four-stage Compressor as built for Oxygen or Hydrogen to 5000 lbs. This type is extensively used for Liquefying Air, etc.



**If you have any special compressing problems, submit them to us. Our long experience in this field enables us to meet the most difficult conditions.**

*Catalogs and full information on request.*

## WESTINGHOUSE TRACTION BRAKE COMPANY

FACTORIES: WILMERDING, PA., and MILWAUKEE, WIS.

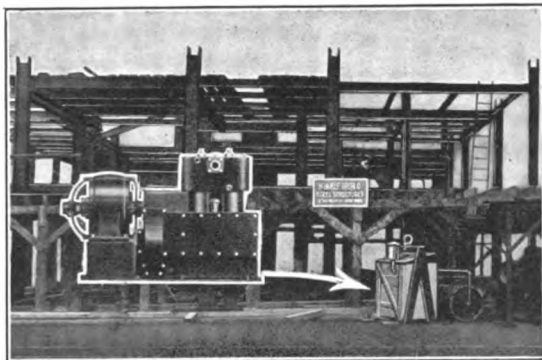
Atlanta, Ga.  
Boston, Mass.  
Chicago, Ill.  
Columbus, O.

Denver, Col.  
Houston, Tex.  
Los Angeles, Cal.

Mexico City  
New York, N. Y.  
Pittsburgh, Pa.

San Francisco  
Seattle, Wash.  
St. Louis, Mo.  
St. Paul, Minn.

**Manufacturers of Westinghouse and National Steam-, Motor- and Belt-Driven Air Compressors and Accessories**



### SPECIFICATIONS

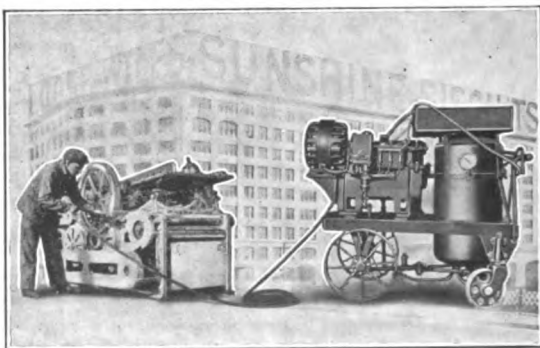
Piston displacement, 75 cu. ft.; cylinder,  $8\frac{1}{2}$ " x 6"; crank shaft R. P. M., 188; armature R. P. M., 1100; H. P. against 90 lbs. pressure, 13.5; length, 70"; width,  $25\frac{1}{2}$ "; height,  $45\frac{1}{2}$ "; weight, 3,000 lbs.

**National E-3 Air Compressor, Motor-Driven, Automatically Controlled, Used by the Hinkle Iron Co., Operating Two to Three "Guns" on Steel Construction Work in New York Subway**

The National E-3 Type of Direct Connected Motor Air Compressor embodies high efficiency and absolute reliability. Is built for continuous service at 100 lbs. pressure. Is a single stage, self-contained unit. Is used in railroad yards for charging and testing train air brakes, also is used to operate fog signals in the U. S. Light House Service. Has water jacketed cylinders and heads.

### SPECIFICATIONS

Piston displacement, 11.4 cu. ft. per min.; cylinder,  $5$ " x  $2\frac{1}{4}$ "; crank shaft R. P. M., 202; H. P. at 90 lbs. pressure, 1.75; motor R. P. M., 1400; suction pipe, 1"; discharge pipe,  $\frac{3}{4}$ "; length,  $33\frac{1}{2}$ "; width,  $20\frac{1}{2}$ "; height,  $21\frac{1}{4}$ "; weight, 775 lbs. Other sizes up to 57 cu. ft. displacement, 10 H. P. at 90 lbs. pressure and 1700 lbs. weight, with corresponding increased dimensions, etc. Send for Publication No. 400.

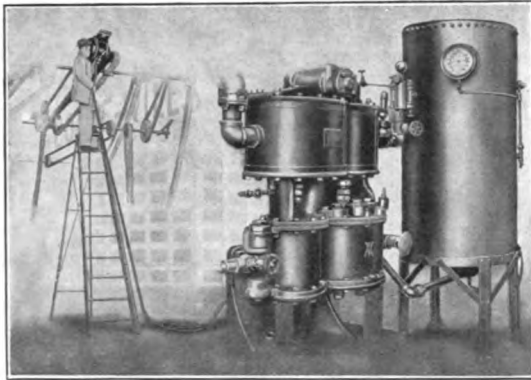


**National H-1 Portable Air Compressor Outfit Used in the Loose-Wiles Sunshine Biscuit Plant at Long Island City, N. Y.**

The National H-1 Portable Air Compressor Outfit is ideally adapted for use in mercantile establishments, manufacturing plants and in construction work. It is easily hauled from place to place. Is always available for instant use. Motor, compressor and steel reservoir, together with accessories, are mounted on a specially built truck with steel wheels and axles.



# WESTINGHOUSE TRACTION BRAKE COMPANY



Westinghouse 10½" C. C. Steam-Driven Compressor Installed in the Loose-Wiles Sunshine Biscuit Plant at Long Island City, N. Y.

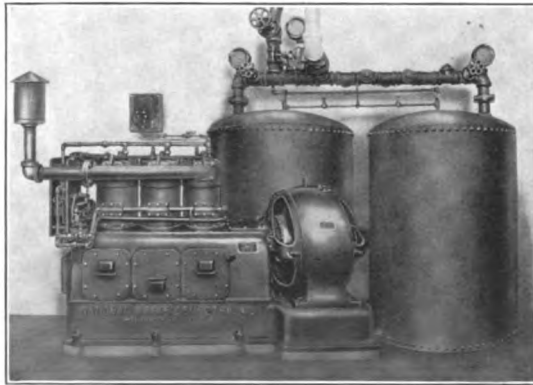
### SPECIFICATIONS

Diameter of high pressure steam cylinder, 10½"; low steam, 16½"; high air, 9½"; low air, 14½"; stroke, 12". Steam admission pipe, 1½"; steam exhaust, 2½"; air admission, 2½"; air delivery, 1½". Designed for steam pressure of 100 lbs. working against 80 lbs. air pressure. Makes 131 strokes and has displacement of 150 cu. ft. per min. Height, 52"; width, 42"; depth, 21"; weight, 1800 lbs. Send for Publication No. 9033.

The 10½" Cross Compound Air Compressor is a development of the railway locomotive air brake type to suit contracting and industrial service. Embodies extreme simplicity in design, absolute reliability in action, durability and low maintenance expense. Is rugged, compact and of neat appearance. Suited for wide range of industrial purposes.

### SPECIFICATIONS

Piston displacement at 90 lbs. pressure, 150 cu. ft. per min.; cylinders, 8½" x 9"; crank shaft R. P. M., 170; H. P. at 90 lbs. pressure, 27; suction pipe, 2½"; discharge pipe, 2½"; water cooling pipe, ¾"; length, 93"; width, 33"; height, 50½"; weight, 6200 lbs. Send for Publication No. 401.



National 3VS Used for General Compressed Air Service in the Engine Room of the Equitable Life Building, 120 Broadway, New York City

The National 3VS Compressor is ruggedly and compactly built in both stationary and portable units, self-contained, electrically driven, automatically controlled, and requires very little attention after once installed. Cylinders and cylinder heads are completely water-jacketed. Designed for continuous service against 90 lbs. pressure. Herringbone pinion and gear. Complete automatic controlling devices permit starting of direct current compressors with not to exceed one-half full load current, and alternating current compressors with not to exceed full load current. Three vertical cylinders and 120 degree spacings of crank shaft assures quiet and smooth operation.



# WORTHINGTON PUMP AND MACHINERY CORPORATION

115 BROADWAY, NEW YORK

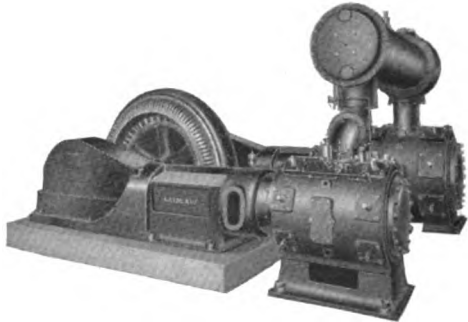
Laidlaw Works: CINCINNATI, OHIO

Branch Offices in All Principal Cities

**Laidlaw Feather Valve Air Compressors, Vacuum Pumps, High Duty Pumping Engines**

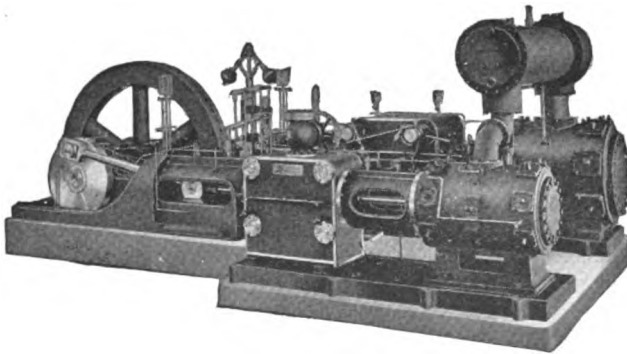
## MOTOR DRIVEN COMPRESSORS

Laidlaw Feather Valve Power-Driven Compressors are driven by either direct-connected engine type motor, or by belt or rope drive. The unique feature of these machines is found in the use of the Laidlaw Feather Valve; efficiency, durability and noiseless operation are thus secured. Laidlaw Power-Driven Compressors are either single-, two-stage or multi-stage. They are built for any working pressure up to 3500 lbs. per sq. in.



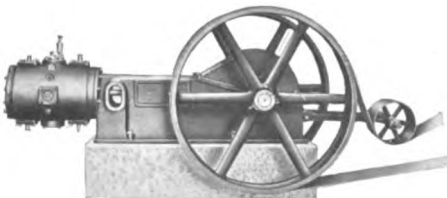
## HEAVY DUTY CORLISS COMPRESSORS

Where a large capacity is needed, Laidlaw Steam-Driven Compressors are made with full releasing, automatic Corliss steam gear, embodying every refinement and improvement found in the best Corliss power engine. The compressor end is identical with that used on power-driven compressors.



Corliss Feather Valve Compressor

## SMALL LAIDLAW COMPRESSORS



Single-Stage Belt-Driven Feather Valve Compressor

The same refinement of detail, and the same rugged construction, which characterize the larger Laidlaw Air Compressors are found in the smaller ones. Single belt and steam-driven compressors are built in capacities ranging from 100 cu. ft. per min. and for pressures ranging from 30 to 100 lbs. per sq. in.

L 269.8

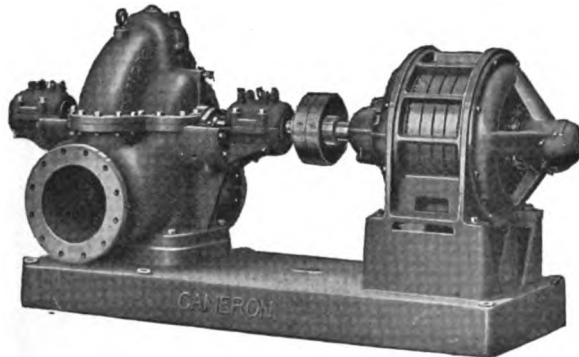
## **A. S. CAMERON STEAM PUMP WORKS**

11 BROADWAY, NEW YORK

Offices in All Principal Cities of the World

**Designers and Builders of Centrifugal Electric Pumps; Piston and Plunger Simplex Steam Pumps for All Classes of Service**

### **CAMERON DOUBLE SUCTION VOLUTE PUMP**



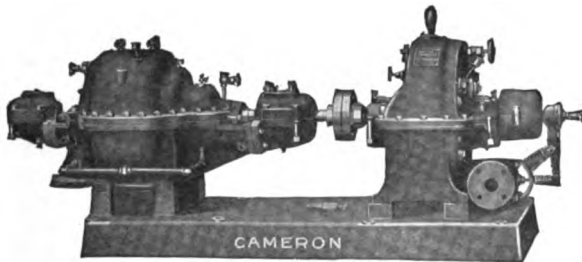
Cameron Centrifugal Pumps are the most modern in design, and have proved highly efficient and economical.

The Double Suction Volute Pump is especially adapted for general service. The casing is horizontally split, allowing quick, easy access to all working parts. The impeller is enclosed, and perfectly balanced. Built for capacities from 50 to 15000 G. P. M., for heads from 10 to 200 feet. Can be direct-connected to electric motor, steam turbine or other forms of power drive.

345

*Bulletin No. 7150*

### **CAMERON MULTI-STAGE TURBINE PUMP**



The Cameron Multi-Stage Turbine Centrifugal Pump is simple and compact, strong and dependable. All parts accessible by means of the horizontally split casing.

This pump gives an exceptionally high efficiency over a wide range of capacity. The cost of upkeep is very low.

It is built in two, three and four stages for a wide variation of speed and capacities from 75 G. P. M. to 2500 G. P. M., against heads from 120 to 800 feet. The drive may be steam turbine or any available motive power.

*Bulletin No. 7251*

**CAMERON STEAM PUMPS** are adapted to all classes of service. They have fewer working parts than any other steam pump, and none exposed. Only four pieces in the Steam Mechanism. By merely removing the valve chest cover on the water end the whole interior of the valve chamber is plainly visible.

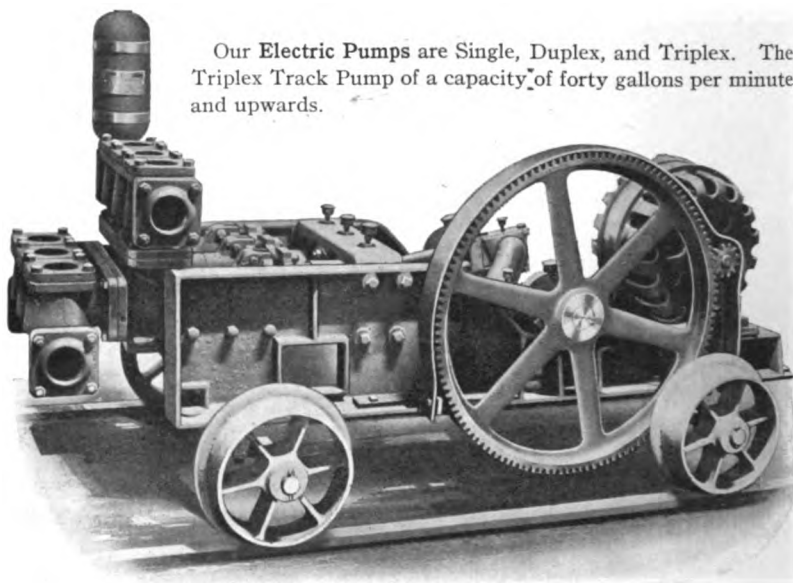
All the way through it is compactly and ruggedly constructed.

*Bulletin No. 7104*

## BOYTS, PORTER & COMPANY

CONNELLSVILLE, PA.

**Manufacturers of Electric, Steam and Air Driven Pumps**



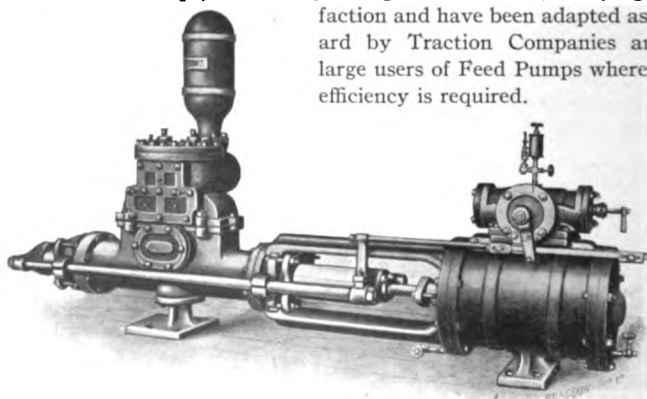
Our Electric Pumps are Single, Duplex, and Triplex. The Triplex Track Pump of a capacity of forty gallons per minute and upwards.

346

We make bronze lined, cement lined, wood and lead lined pumps of any capacity.

The types are pot valve, piston, plunger and double plunger.

Our **Boiler Feed Pumps**, with self-grinding bronze valves, always give satisfaction and have been adapted as a standard by Traction Companies and other large users of Feed Pumps where greatest efficiency is required.



# THE DEMING COMPANY

SALEM, OHIO, U. S. A.

NEW YORK OFFICE AND STOCK: 152 Chambers Street

Manufacturers of Hand and Power Pumps for All Uses

## DEMING POWER PUMPS

DEMING Power Pumps are made in such a variety of styles and sizes that their range of application is practically unlimited where belts, water wheels, electric motors, or steam, gas or gasoline engines are available sources of power. The types include Single- and Double-Acting Triplex Pumps for various services, Deep Well Power Working Heads, Artesian Well Cylinders, Rotary and Centrifugal Pumps. They are all built upon such lines as to insure great durability, efficiency, reliability, ease of operation and low cost of maintenance.

### Deming Single-Acting Triplex Plunger Pump

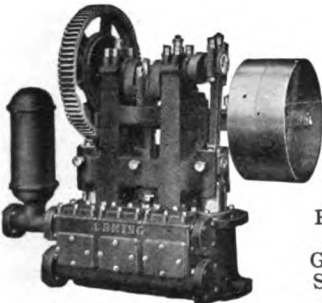
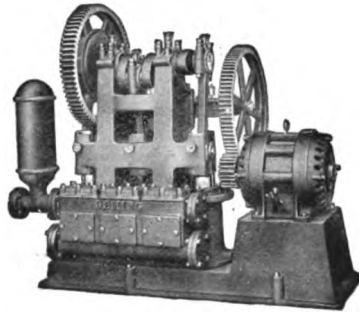


Fig. 50  
for  
General  
Service

Size 7x8 to 8 1/2 x 8



Size 5 1/2 x 8 with Type "B" Drive

Fig. 50 Single-Acting Triplex Pump is designed for water works, hydraulic elevator service, boiler feed, pulp grinders and general water supply.

Deming Triplex Pumps embody the principle of the three-throw crank shaft, with the crank pins at an angle of 120 degrees with each other, by which arrangement the strokes follow and overlap one another. This results in a continuous and uniform action upon the fluid being pumped, and insures an easy flow through the delivery pipe, with a corresponding high degree of efficiency in the operation of the pump.

All of our triplex pumps, whether of low service, medium or heavy pressure types, have the plungers with crossheads outside guided, thereby relieving the stuffing-box glands of lateral pressure due to the side thrust of the connecting rods.

FIG. 50, STANDARD SIZES, CAPACITIES, ETC.

PLUNGERS				DIAM. OF PIPES		PLUNGERS				DIAM. OF PIPES	
Diam. In.	Stroke In.	CAPACITY Gallons Per Hr.	Max. Working Pressure Lbs.	Suction In.	Discharge In.	Diam. In.	Stroke In.	CAPACITY Gallons Per Hr.	Max. Working Pressure Lbs.	Suction In.	Discharge In.
2	2	340	150	1 1/2	1	6	8	9660	140	4	3
2 1/2	2	532	150	1 1/2	1	7	8	13400	150	5	4
2 1/2	3	684	150	2	1 1/2	8	8	17240	150	5	4
3	3	972	150	2	1 1/2	8 1/2	8	19460	140	6	5
3 1/2	3	1320	150	2	1 1/2	9	10	24800	160	8	6
4	4	1800	150	2 1/2	2	10	10	27600	150	8	6
4	4	2340	150	2 1/2	2	11	12	37400	160	10	8
4 1/2	4	3540	160	2 1/2	2	12	12	44400	150	10	8
5	6	4440	150	3	2 1/2	12	14	49200	150	12	10
5 1/2	6	5460	150	3	2 1/2	13	14	58000	140	12	10
6 1/2	8	8840	150	4	3						

Complete 192-page Power Pump Catalogue Mailed to Engineers on Application.

## DE LAVAL STEAM TURBINE CO.

TRENTON, N. J.

Builders of Steam Turbines, Centrifugal Pumps, Blowers and Compressors  
Speed-Reducing Gears

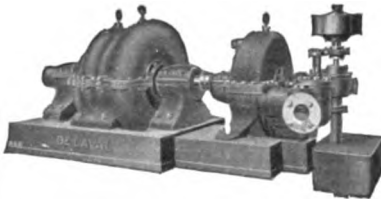
### We Have Specialized on Turbine-Driven Machinery



Alternating and Direct-Current Generators



Centrifugal Pumps for all Heads and Capacities



Centrifugal Blowers and Compressors for all Pressures and Volumes



Rope and Belt Drives



Driving Slow and Moderate Speed Machinery,  
Such as Rolling Mills, Paper Machines,  
Ships' Propellers, Etc.

We have successfully adapted the steam turbine to driving all classes of apparatus.

For centrifugal compressors and small high head centrifugal pumps the steam turbine can efficiently be directly connected to the driven machine. For the great majority of cases, however, it is more advantageous to run the steam turbine and driven machine, such as direct-current generators or large centrifugal pumps or blowers at different speeds. This is accomplished with high efficiency and with maximum simplicity, compactness and reliability, by means of the DeLaval double-helical speed-reducing gear.

Where this is employed, the turbine can in all cases be designed to have the greatest simplicity and highest efficiency possible for the steam and power conditions.

DeLaval machinery is designed, manufactured, tested and guaranteed by one organization and under one responsibility. Replacements or repairs supplied from the DeLaval factory can be installed by unskilled men, and will fit, because they are manufactured in a high-class shop on a limit-gage, interchangeable basis. You can order them by telegraph if necessary, as an identifying number is stamped upon each part.

## **EPPING-CARPENTER PUMP CO.**

MAIN OFFICE AND FACTORY  
PITTSBURGH, PENNA.

NEW YORK OFFICE, 90 West Street  
CLEVELAND OFFICE, 328 Champlain Ave.

CHICAGO OFFICE, Railway Exchange Bldg.  
MINNEAPOLIS OFFICE, 5021 Bryant Ave.

Sales Offices or Agencies in All Principal Cities

**Manufacturers of Pumping Machinery and Condensers**

**EPPING-CARPENTER** manufactures direct acting pumps fitted with simple, compound, and triple expansion piston valve steam ends.

Simple and Compound Steam Ends can be equipped with our balanced piston valve and adjustable valve gear, if specified.

**WATER ENDS**—Our Pumps are fitted with Outside End Packed, Pot Type Water ends, as illustrated by Cut 622, also Outside Center Packed Plunger type, and piston Packed Type Water ends.

For **WATER WORKS SERVICE**, we manufacture Triple Expansion Pumping Engines, as illustrated by Cut 600, Corliss Cross Compound Pumping Engines, as shown on Cut 727, and Meyer Gear Pumping Engines.

For **HYDRAULIC SERVICE** we offer High Efficiency Power Pumps, equipped with Herringbone Gears, and fitted with water ends as illustrated in Cut 766.

**CENTRIFUGAL PUMPS**—We manufacture Volute and Multi Stage Centrifugal Pumps, either for belt, motor or steam turbine drive.

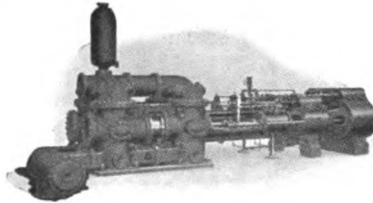
For **OIL LINE PUMPS**—We offer Triple Expansion, Corliss and Power Pump types, complete in every detail, which have given exceptional service.

*We have manufactured Pumping Machinery exclusively for FIFTY-ONE YEARS, and invite Engineers to send their inquiries. We are pleased to furnish full information in reference to our products, upon application.*

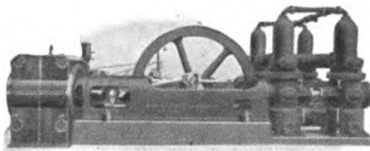
**OVER 14000 PUMPS IN SERVICE FIFTY-ONE YEARS IN BUSINESS**



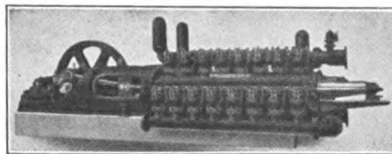
Cut No. 622  
Outside End Packed Pot Type Pump



Cut No. 600  
Triple Expansion Center Packed Pump



Cut No. 727  
Corliss Cross Compound Pumping Engines



Cut No. 766  
High Efficiency Power Pump

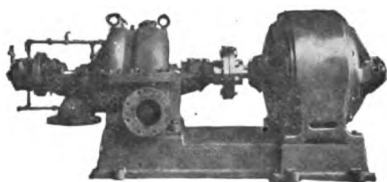
## MORRIS MACHINE WORKS

BALDWINVILLE, N. Y.

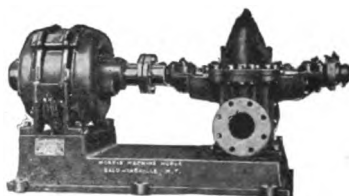
Branch Offices in Principal Cities

**Builders of Centrifugal Pumping Machinery, Hydraulic Dredges, Stationary and Marine Engines**

We build CENTRIFUGAL PUMPS for almost any service and of all types, including side suction and double suction, vertical or horizontal shaft. STAGE PUMPS for high heads. TWIN PUMPS for large capacities and high speeds. Or will design SPECIAL PUMPS to suit special conditions. As the oldest and largest firm in the country building exclusively this class of machinery, our experience of over fifty years has covered all services for which Centrifugal Pumps have been used.



Horizontally Split Multi-Stage Pump



Horizontally Split Single-Stage Pump

### MORRIS CENTRIFUGAL PUMPS

are perfectly balanced, require small space and foundation; have high efficiency; are equally suitable for from small up to very large capacities, and can handle sand or solids with the water without injury. These pumps direct connected to reciprocating engines are suitable for moderate heads, or direct connected to electric motor or steam turbine (or belt driven) for high heads. For heads above 100 feet, pumps are preferably built in stages.

The SINGLE- and MULTI-STAGE horizontally split pumps, illustrated, are built to meet the demand for a pump capable of high speed and efficiency. We build them from 2" up to 20" discharge. They are bronze fitted and where pumping acids the entire water end is made of acid resisting bronze. This type is used by the Navy Department, arranged for belt, motor or turbine drive as desired.

### DREDGING PUMPS

MORRIS DREDGING PUMPS are made in sizes from 2" discharge and upward, built of cast iron, carbon or manganese steel, both lined and unlined. They are belt driven or direct connected to steam engines. For the sake of economy 15-inch and larger dredging Pumps are usually directly connected to compound or triple expansion steam engines. We have also many dredging pumps in service directly connected to electric motors. We can furnish pumps only or the complete dredge, including all machinery.

### STEAM ENGINES

We also build a complete line of STATIONARY and MARINE ENGINES, in single cylinder, compound and triple expansion types from 1½ up to 1000 H. P. We also make a specialty of pumps for surface condensers.

*Write for complete catalog today.*





## PLATT IRON WORKS

GENERAL OFFICES: DAYTON, OHIO

Branch Offices in Principal Cities

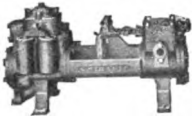
**"Platt" Centrifugal and Turbine Pumps; "Smith-Vaile" Steam and Power Pumps and High-Duty Pumping Engines; "Stilwell" Feed Water Heaters; "Victor-Francis" Low and High Head Water Wheels; "Smith-Vaile" Oil Mill Machinery and Equipment**



### PLATT DOUBLE SUCTION CENTRIFUGAL PUMPS

Split case features insure accessibility. Their rugged construction guarantees efficient and continuous service whether installed where every facility is at hand, or in the most isolated parts of the world.

*Fully described in bulletins Nos. 775, 762, 793.*



### SMITH-VAILE YOKE TYPE BOILER FEED PUMPS

Provided with removable and interchangeable water cylinder linings and adjustable packed water pistons, permitting compensation for wear.

*Bulletin No. 788 will interest every engineer.*



### STILWELL FEED WATER HEATERS

Class "O" Type

Either Thoroughfare or Switch Valve Type. Fitted with float controlled or water seal overflow as may be necessary. Single piece castings, special design for raw water control, perfect filtration, make them pre-eminent.

*Bulletins Nos. 783 and 784 are descriptive.*

### VICTOR-FRANCIS HIGH AND LOW HEAD WATER WHEEL

The epoch-making installation of Victor-Francis equipment to produce 50,000 horse power at Cohoes, N. Y., indicates the high efficiency that can be obtained with well designed and carefully built Platt products.

*Bulletins Nos. 789, 790, 791 describe the line.*



### SMITH-VAILE COMPOUND DUPLEX PUMPING ENGINES

Economical steam construction by multiple expansion. Undeveloped energy of steam after the completion of the stroke in initial cylinders is conserved and employed in expansion cylinders. A saving of from 25 to 35 per cent.

*Bulletin No. 788 gives details.*

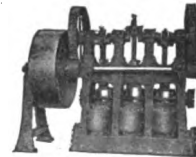


### SMITH-VAILE TRIPLEX PUMPS

Belt Drive Chain Drive Direct Geared

Four bearings insure reliability for day-by-day service in a practically unlimited range of application. May be belt driven from any available source of power, or direct connected by coupling, gears or chain to any form of motive power.

*See Bulletin No. 781.*



*No matter whether they are installed under the most favorable conditions or in the most isolated parts of the world, Platt products are pre-eminent for quality and service.*

Engineers, specially trained for particular problems, are maintained in every department. This assures you the best possible service.

Catalogs, bulletins, drawings and complete data covering our lines sent promptly on request.

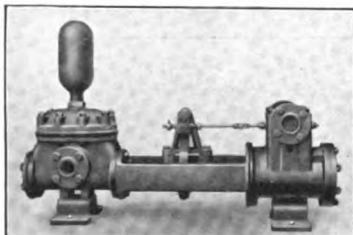
# **WORTHINGTON PUMP AND MACHINERY CORPORATION**

**MAIN OFFICE: 115 BROADWAY, NEW YORK**

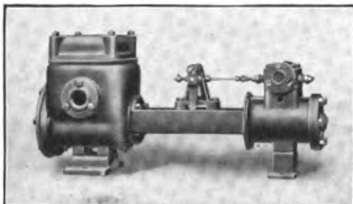
**BLAKE-KNOWLES WORKS: EAST CAMBRIDGE, MASS.**

**Branch Offices in All Principal Cities**

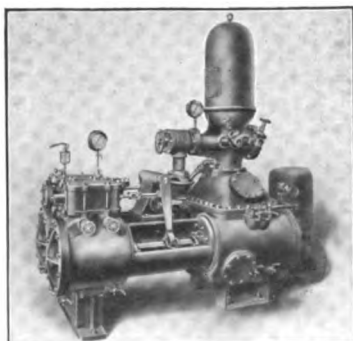
**Simplex Pumps, Vacuum Pumps, Underwriter Fire Pumps, Boiler Feed Pumps**



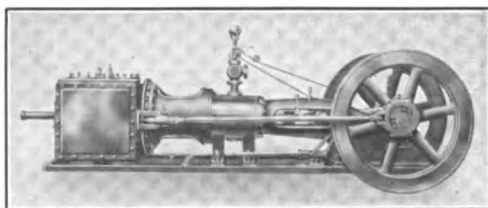
**Simplex Style "A"  
Boiler-Feed Pump**



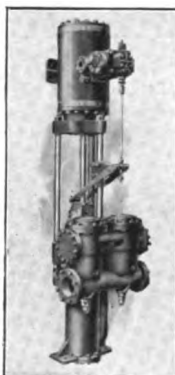
**Simplex Steam Heating  
Vacuum Pump**



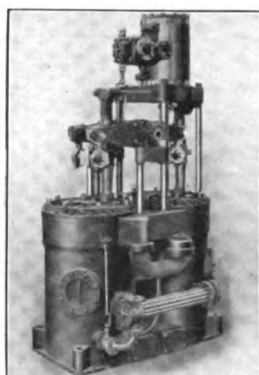
**Underwriter Fire Pump**



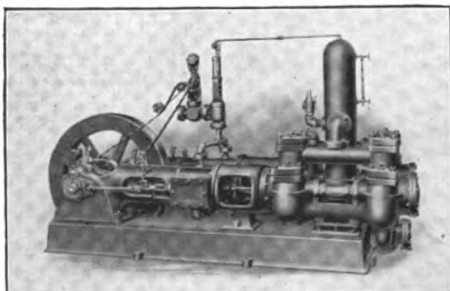
**Rotative Dry Vacuum Pump**



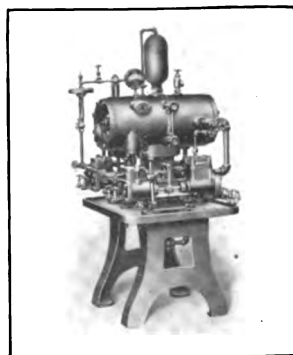
**Vertical Simplex  
Piston Pump**



**Vertical Twinplex  
Wet and Dry Vacuum Pump**



**Flywheel Sugar House Pump  
Filter Press Work**



**Fuel Oil Pump System  
B 324.8**

# LAMMERT & MANN CO

WOOD & WALNUT STS., CHICAGO, ILL.

**Manufacturers of Rotary Vacuum Pumps, Centrifugal Pumps, Pressure Pumps  
Engineers—Machinists**

## LAMMERT VACUUM PUMPS

Pistonless      Valveless      Rotary

Our pumps are designed for the *highest possible dry vacuum* and meet a long-felt want for a high grade, high duty pump, where a high, dry vacuum is required.

To give an even, high vacuum there must be no valves to leak or stick, no piston and rings to wear out and the lubrication must be perfect. The LAMMERT Pump not only meets these vital requirements, but does it with reliability, low maintenance cost and minimum power.

We avoid wear and leakage by the use of simple device peculiar to the LAMMERT Pump and by constantly flooding oil upon the working parts by automatic oilers.

With our new silencer and the absence of reciprocating parts, the LAMMERT Pump is free from noise and vibration.

LAMMERT Vacuum Pumps are made in several styles and sizes to meet the various demands of service.

The smaller, light service pumps, which are capable of easily attaining a vacuum of 26 inches of mercury, are air-cooled, having exceptionally large radiating surface for that purpose. Size Numbers 2, 3 and 4 with capacity of 7, 14 and 24½ cubic ft. per min., respectively.

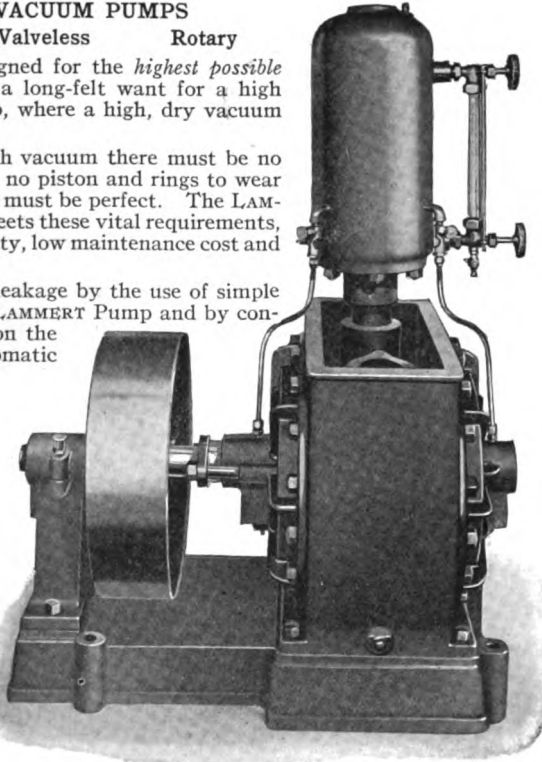
The oiling system in these pumps is of the capillary type. The oil reservoir holds a supply sufficient to run the pump for thirty hours. No oil is wasted as the oil starts and stops coincident with the starting and stopping the pump.

The larger pumps are water-cooled and are capable of easily maintaining continuously a vacuum of 27 inches of mercury at sea level. Size Numbers 5, 5½, 6 and 7 with capacity of 55, 67, 90 and 180 cubic ft. per min., respectively.

With the tandem high duty, water-cooled pumps we can maintain the highest possible vacuum. Size Numbers 5A, 5½A, 6A with capacity of 55, 67 and 90 cubic ft. per min., respectively.

## CENTRIFUGAL PUMPS—CONTRACT WORK

*We also build rotary pumps to handle the heaviest products*



Single Stage Water-Cooled Pump

## NOVO ENGINE CO.

LANSING, MICH.

Manufacturers of Novo Gasoline and Kerosene Engines from 1 to 15 H. P., Hoists, Force Pumps, Diaphragm Pumps, Air Compressors, Saw Rigs, Etc.



The Novo Engine is exceedingly simple and reliable in every way. They are built of the very best possible material for long and continuous service under the hardest of conditions. Novo Engines are frost-proof, simple in construction, with few working parts, and with practically nothing about them to get out of order. Practically anyone can operate the Novo Engines entirely satisfactorily. Novo Engines are built in the following sizes: 1, 1½, 2, 3, 4, 6, 8, 10, 12 and 15 H. P. The 12 and 15 H. P. sizes are of the two-cylinder type.

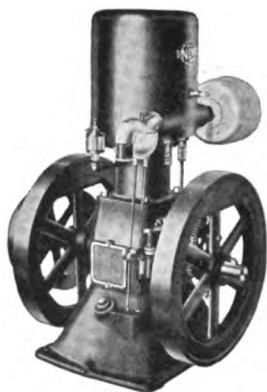


Fig. 255

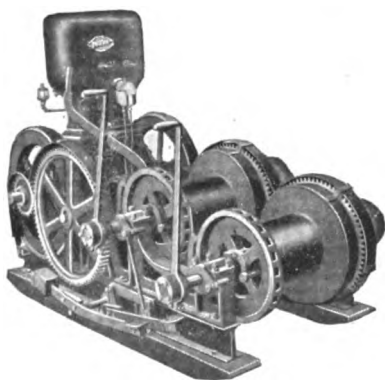


Fig. 172

Novo Hoists are made in forty-four different sizes and types, all combinations, both single and double drum, one or two speeds, reversible or non-reversible. Novo Hoists are light in weight for the power developed so they are easily moved about. They can be started and stopped as soon as the job is ready and completed so there is no waste of fuel. They take up very little space so can be used anywhere. The Type DH Hoist shown in Fig. 172 shows the double drum, reversible hoist with 15 H. P. Engine.

Novo Saw Rigs are built to stand the hard usage demanded of them on all construction jobs. They will save enough time to pay for themselves on one fair-sized job. The No. 4 Saw Rig shown in Fig. 134 with 4 H. P. Engine has all the attachments for practically any job. The No. 5 Saw Rig with a 4 H. P. Engine has a 16 in. cut off and 16 in. rip saw only.



Fig. 134

## NOVO ENGINE CO.

### NOVO ENGINES AND OUTFITS (Continued)

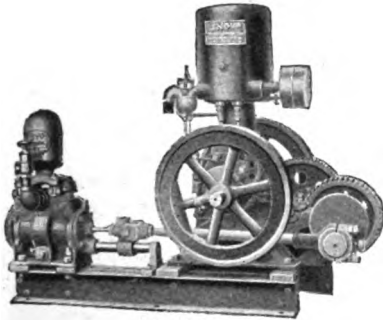


Fig. 14139

**Novo Triplex Pumping Outfits** illustrated in Fig. 1446 are also recommended for high pressure pumping where a steady pressure is necessary. The strokes of the three cylinders overlap thus maintaining a uniform supply. Built in any size up to 15 H. P.

**Novo Force Pumping Outfits** will handle practically any work where a dependable water supply is required. The Type U Outfit shown in Fig. 14139 is built for high pressure or long distance pumping. It is especially recommended for the job requiring water under pressure, two or three miles from the source of supply.

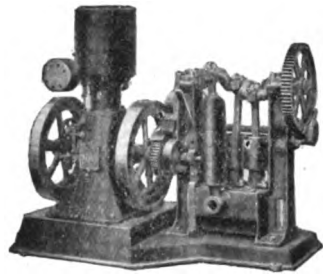


Fig. 1446

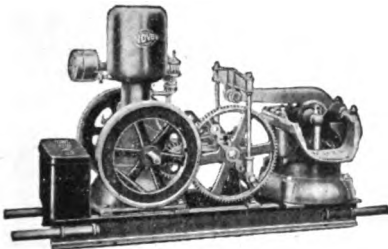


Fig. 179

**Novo Air Compressor Outfits** as shown in Fig. 276 with single cylinder compressor or double cylinder types, not illustrated, have capacities from 5 to 140 cu. ft. of free air per minute. Will operate all kinds of air tools perfectly satisfactorily.

Our books, "Reliable Power," and "Standardized Power," give full information on all **Novo Engines and Outfits**. Yours for the asking.

**Novo Diaphragm Pumping Outfits** shown in Fig. 179 mounted on skids or hand trucks with one or two pumps as desired, are exceedingly useful for draining excavations, trenches, etc., where muddy and gritty water has to be handled.

The Novo Outfits also include chain-driven and direct-connected centrifugal pumping outfits. They move large volumes of muddy or gritty water quickly.

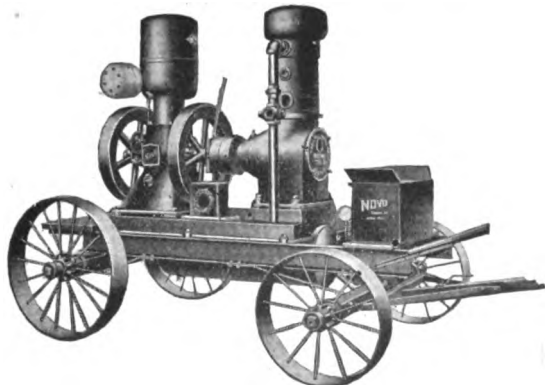


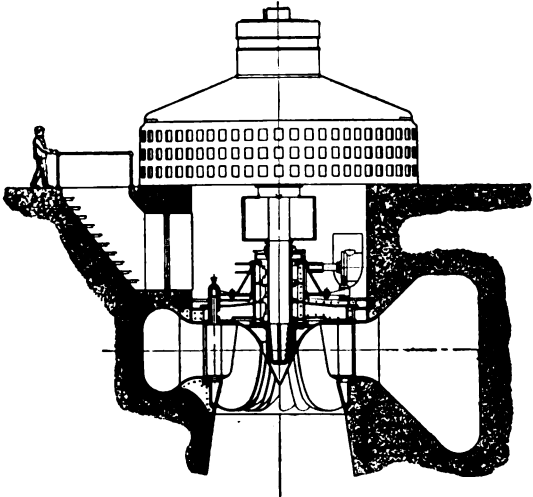
Fig. 276

I. P. MORRIS COMPANY

HYDRAULIC DEPARTMENT

PHILADELPHIA, PA.

Specialists in the Design and Construction of Hydraulic Turbines of High Power and High Efficiency



HIGHEST POWER TURBINE OF CONCRETE CASING TYPE EVER CONSTRUCTED

Cross section through 20,000 H. P. turbine in the plant of the Laurentide Company Limited, Grand Mere, P. Q., Canada.

Designed and built by the I. P. Morris Company.

Among the contracts for turbines of this type awarded to the I. P. Morris Company may be mentioned:

Plant	No. of Units	Head in Feet	R. P. M.	Unit Capacity H. P.	Total Capacity H. P.
Appalachian Power Company, New River, Va.: Station No. 2.....	4	49	116	6,000	24,000
Station No. 4.....	3	34	97	3,500	10,500
Mississippi River Power Co., Keokuk, Iowa.....	8	32	57.7	10,000	80,000
J. G. White & Co., Stevens Creek Dev., Ga.....	5	27	75	3,125	15,625
	2	27	200	450	900
Alabama Power Company, Coosa River, Ala.....	4	68	100	17,500	70,000
	1	68	100	19,500	19,500
Cedars Rapids Mfg. & Pr. Co., P. Q., Canada.....	9	30	55.6	10,800	97,200
	3	30	150	1,500	4,500
Laurentide Company, Ltd., Grand Mere, P. Q., Can.	6	76	120	20,000	120,000
Northern Ontario Light & Power Co., Cobalt, Can.....	2	30	150	1,500	3,000
Turners Falls Pr. & Elec. Co., Turners Falls, Mass.....	6	54	97.3	9,700	58,200
Pennsylvania Water & Pr. Co., Holtwood, Pa.....	1	63	94	16,500	16,500
Columbia Mills Incorporated, Minetto, N. Y.....	6	17.5	68.2	2,200	13,200
Mattagami Pulp & Paper Company, Ontario, Can.....	2	45	112.5	4,500	9,000
Abitibi Power & Paper Co., Ltd., Ontario, Can.....	4	55	128.5	6,000	24,000

Total capacity of turbines of the above type (H. P.) 566,125

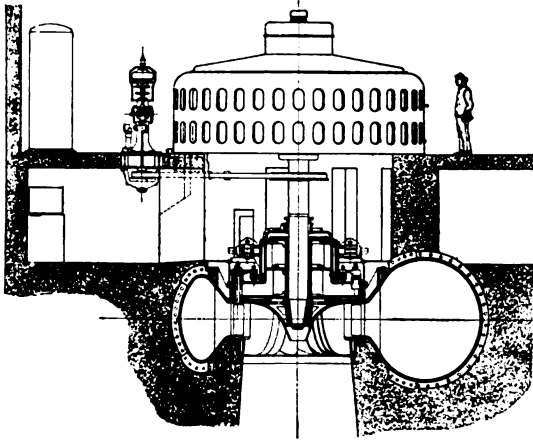
Turbines of the above type are usually installed for heads up to approximately 80 feet.

# I. P. MORRIS COMPANY

HYDRAULIC DEPARTMENT

PHILADELPHIA, PA.

Specialists in the Design and Construction of Hydraulic Turbines of High Power and High Efficiency



**LARGEST CAST IRON  
VOLUTE CASING EVER  
CONSTRUCTED**

Cross section through  
7500 H. P. turbine in the  
plant of the Canadian  
Copper Co. Turbine, On-  
tario, Canada.

Designed and built by  
the I. P. Morris Company.

Among the contracts for turbines of this type awarded to the I. P. Morris Company may be mentioned:

Plant	No. of Units	Head in Feet	R. P. M.	Unit Capacity H. P.	Total Capacity H. P.
Appalachian Power Company, New River, Va.:					
Station No. 2. Exciters.....	2	49	00	430	860
Station No. 4. Exciters.....	2	34	330	250	500
Great Western Power Company, Oroville, Cal.....	4	525	400	18,000	72,000
	2	465	400	18,500	37,000
Phoenix Construction Co. (Utah Pr. & Light Co.):					
Grace Station, Idaho.....	3	482	514	18,500	49,500
Onelda Station, Idaho.....	3	140	180	15,000	45,000
Cove Dev., Idaho.....	1	90	171.5	10,500	10,500
Olmsted Station, Idaho.....	1	338	514	7,700	7,700
Great Northern Power Company, Duluth, Minn.....	1	355	375	15,000	15,000
Northern Canada Power Co., Timons, Ont., Can.....	1	34	138.5	2,500	2,500
Rochester Railway & Light Co., Rochester, N. Y.....	2	130	180	18,000	32,000
Keith Paper Company, Turners Falls, Mass.....	1	38	225	1,110	1,110
Canadian Copper Company, Turbine, Ont.....	1	85	150	7,500	7,500
Western Carolina Power Co., Bridgewater Dev., N. C.	2	115	171.5	13,200	26,400
Riordon Pulp & Paper Co., Hawkesbury, Ontario, Can.	1	200	450	3,600	3,600

Total capacity of turbines of the above type (H. P.)

311,170

Turbines of the above type are usually installed for heads over 80 feet.

Of the total capacity including all types of turbines contracted for during the last five and one-half years, 76% have been of the types illustrated.

Total capacity of turbines built or under construction by  
I. P. Morris Company, 1,913,000 H. P.



## RODNEY HUNT MACHINE CO.

81 MILL STREET, ORANGE, MASS.

**Manufacturers of Turbine Water Wheels, Water Controlling Apparatus, Power Transmission Equipment, Underwriter Rotary Fire Pumps, Textile Wet Finishing Machinery**

### HUNT WATER CONTROLLING APPARATUS

Rodney Hunt Water Controlling Apparatus embraces a large variety of devices. Their range of application is practically unlimited where water is used for any purpose. They are especially designed for Water Power Plants, Reservoirs, Storage Dams, Filtration and Irrigation Systems. The more important lines are as follows:

#### Pipes, Penstocks, Flumes and Accessories

**STEEL AND WOOD PIPES AND PENSTOCKS:** For water power requirements. Round, rectangular and special shapes.

**STEEL AND WOOD FLUMES:** For water power requirements.

**STAND PIPES AND SURGE TOWERS:** For water power requirements.

**RELIEF VALVES AND VENT PIPES:** For relief of both pressures and vacuums.

**GAUGES:** For measuring water levels, pressures and vacuums.

#### Gates and Valves

**IRON GATES AND VALVES:** For medium and large capacity requirements. All sizes and shapes. With and without Bronze facings.

**WOOD GATES AND FRAMES:** For canals, storage dams and reservoirs.

#### Gate Hoists and Floor Stands

**GATE HOISTS:** For the control of any style gate or valve. Gear, Screw, Worm and Worm Wheel and Combined designs. Operated either by hand or electric or hydraulic power.

**FLOOR STANDS:** For the control of all styles of gates and valves. Plain and geared designs. Operated by hand or power.

#### Trash Racks and Accessories

**TRASH RACKS:** For canals, intakes, feeders, etc. Improved, extra strong designs, especially easy to clean.

**ACCESSORIES:** Including rakes, fittings, etc.



*Catalogue No. 30, Sec. W. C. A., gives full information and will be sent promptly on request. It is the first complete Catalogue of Equipment and Accessories for Water Controlling as required for Canals, Penstocks, Flumes, Irrigation and Sewage Improvements. A valuable collection of designs and general information.*





# **SOUTHWARK FOUNDRY & MACHINE COMPANY**

**Established 1836**

**PRINCIPAL OFFICE: 400 WASHINGTON AVE., PHILADELPHIA**

## **DISTRICT OFFICES**

**Equitable Building, NEW YORK CITY**

**Railway Exchange, CHICAGO**

**Brown-Marx Building, BIRMINGHAM**

**Designers and Builders of:**

**Hydraulic Machinery**

**Machinery for the Rubber Industry**

**Boiler Shop Machinery**

**Shipyards Machinery**

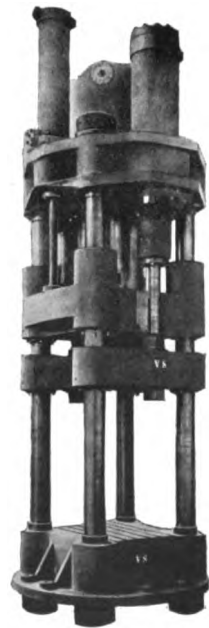
**Scrap Reclaiming Machinery**

**Railroad Shop Machinery**

**Locomotive Repair Machinery**

**Flue Welders**

**Washer Machines**



**Double-Acting Drawing  
Press for Deep Stamp-  
ing Work**

We install complete **HYDRAULIC PLANTS** comprising Presses—all types and sizes; Pumps, Accumulators, Intensifiers, Valves, etc.

We also design and build Turbines, Blowers and the Southwark-Harris Valveless Oil Engine (Diesel Type).

## **R. D. WOOD & COMPANY**

PHILADELPHIA, PA.

**Engineers, Iron Founders, Machinists:—Water and Gas Works Appliances, and Pumping Machinery; Cast Iron Pipe; Gas Holders, Purifiers, Condensers, Coal Gas Plants; Hydraulic Tools and Machinery, Pumping Engines, Centrifugal Pumps; Gas Producers, Gas Producer Plants for Power, Fuel and Metallurgical Purposes, Theisen Washers; General Machinery, Large Loam Castings; Sugar House Apparatus; Valves and Hydrants**

### **CAST IRON PIPE**

Bell and Spigot Pipe from 1 inch to 84 inches in diameter, Flange Special deep bell, High Pressure, Flexible joint for Submarine Work, Standard and Special Fittings, Heavy Loam and Dry Sand Castings.



### **PUMPING ENGINES**

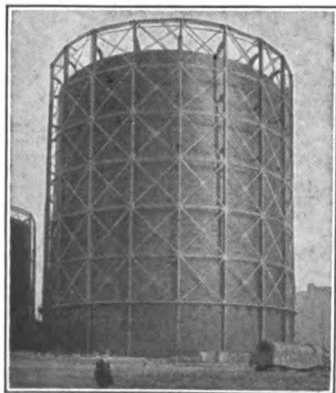
Vertical Triple Expansion, and Direct Acting for Water Works, Sewage, Irrigation and for high pressures. High duty pumping engines of both the crank and fly wheel and direct-acting types. Designed to combine highest economic duty and efficiency with greatest reliability and utmost simplicity.

Estimates and drawings (either exact or preliminary) furnished upon application, with statement of requirements to be fulfilled.

### **CENTRIFUGAL PUMPS**

For Water Works, High Pressure Fire Systems, Irrigation Reclamation, Dredging, Sewage, etc.

Superior in Design—High Efficiency—Reliable Service.



Gas Holders—Single or Multiple Lift—any Capacity.

Heavy Tank and Plate Work.

Purifiers, Scrubbers, Condensers, Gas Works Appliances.

Coal Gas Plants.

Bench Work, Center Seals.

Gas Valves.



## **R. D. WOOD & COMPANY**

---

### **HYDRAULIC MACHINERY**

Hydraulic Presses of every description for the heaviest work, Steam Hydraulic Forging Presses, Punches, Shears, Riveters, Intensifiers, Hoists, Pressure Pumps, Cranes, Valves, etc., etc. For the majority of operations to which hydraulic power can be applied, and especially those requiring very great force exerted through a comparatively short stroke, as in riveting, punching, shearing, lifting, forging and flanging, there is no other system at all comparable with it for efficiency, uniformity, simplicity or economy. This is true for several reasons; primarily in that there is absolutely no motion or power consumed except in the act and at the moment of performing the desired operation.

### **HYDRAULIC VALVES**

**Hydraulic Operating Valves, Check, Foot, Stop and Shock Relief Valves.**

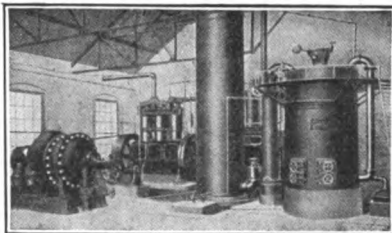
A high grade valve is an essential to the satisfactory operation of hydraulic machinery.

We are building a patented type of operating valve which is giving excellent service. We have also a special line of Check, Foot, Stop and Shock Relief Valves.

### **PRODUCER GAS PLANTS**

We have had years of experience in the building of producers for all kinds of fuel purposes as well as for power, and our customers may be certain of securing apparatus suitable to their requirements both from an economic and operating standpoint.

Our engineering department is at your service, and we would be pleased to have our representative visit your plant and give full details.



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### **GAS WASHERS**

We control for the United States the Theisen Gas Washing Process, which we build for producer and blast furnace gas. This Process was adopted by the United States Steel Company at Gary, and is being put in with all their new construction. It delivers the gas to an engine cleaner than the air in the mixture.

### **GENERAL MACHINERY**

Our shops are well equipped for building large machinery of every description, such as sugar, chemical and similar work.

### **IRON CASTINGS**

We are especially well equipped for making large and intricate loam castings; also castings in dry sand and green sand.

### **HYDRANTS AND VALVES**

Fire Hydrants, Mathews patents for standard and high pressure. Gate, Check, Foot and Air Valves, Valve Boxes, Indicator Posts, Foot Valve and Intake Screens, Hood Racks, etc.

## THE WATSON-STILLMAN CO.

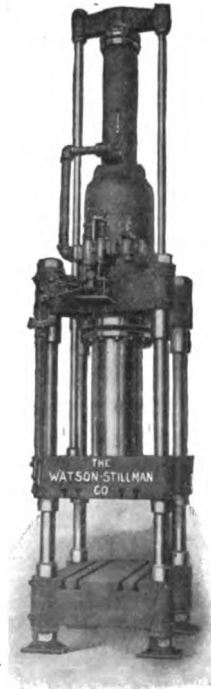
35 CHURCH ST., NEW YORK

**Engineers and Builders of Hydraulic Machinery—Pumps, Valves, Accumulators, Intensifiers, Boosters, Jacks, Pitjacks, Lifts, Punches, Shears, Benders, Straighteners, Riveters, Coping Shears, Bolt Forcers, Baling Presses, Bulldozers, Forging Presses, Metal Extrusion Presses, Forcing Presses, Tunnel Shield Cylinders and Equipment, Etc.**

In our long experience of nearly 70 years, we have designed, built and have patterns for over 5000 complete hydraulic machines for practically every use to which hydraulic pressure has been found adaptable.

### PRESSES

We have a standard line of presses for forcing, force fitting, assembling; presses for broaching, metal forming, metal extruding; presses for die sinking, die forming, embossing; presses for baling metal, scrap, cloth, etc., presses for briquetting of granular materials, presses for forging, drawing, tube drawing; heating presses and chilling presses for forming rubber and composition goods in molds.



Hydraulic Forging Press



Tank Weighted Accumulator

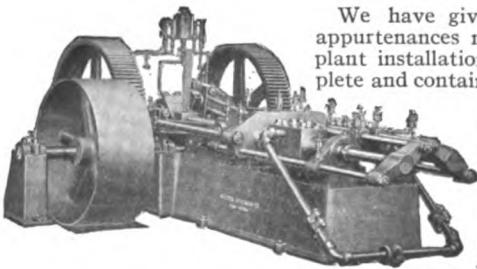
### ACCUMULATORS

We build accumulators in seven types, plain cylinder, inverted cylinder, yoke cylinder, plain and variable pressure, differential ram, hydro pneumatic and intensifier.

### PUMPS

We have given particular attention to the appurtenances necessary to complete hydraulic plant installation. Our line of pumps is complete and contains a standard type for every pressure demand up to 10,000 lbs. per sq. in. and every detail has been worked out to give the maximum of efficiency.

*We are prepared to design special equipment to suit your own specifications.*



High Pressure Pump



## **BRAEMER AIR CONDITIONING CORPORATION**

(Formerly Air Conditioning Department of Warren Webster and Company)

**MAIN OFFICES: LAFAYETTE BLDG., PHILADELPHIA, PA.**

### **BRANCH OFFICES**

**NEW YORK, N. Y., 90 West St.**

**CHICAGO, ILL., 1401 Marquette Bldg.**

### **TERRITORIAL REPRESENTATIVES**

**CLEVELAND, O.**

**CINCINNATI, O.**

**INDIANAPOLIS, IND.**

**ST. LOUIS, MO.**

**KANSAS CITY, MO.**

**MILWAUKEE, WIS.**

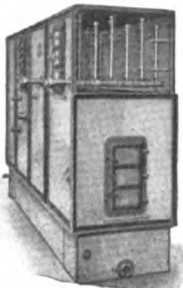
**Manufacturers of Equipment for Maintaining Artificial Atmospheric Conditions in Industrial Plants; Dr. Hill Dust Counter—for Determining the Purity of Air for Dust and Bacteria; Generator Coolers; Webster Air Washers**



**Webster Type "A"  
Air Washer**



**Webster Type "B"  
Air Washer**



**Braemer  
De-Humidifier**

### **THE WEBSTER TYPE "A" AIR WASHER**

Designed primarily for air washing and cleansing in connection with heating and ventilating systems in public buildings, where a moderate cooling effect by evaporation is desired.

### **THE WEBSTER TYPE "B" AIR WASHER**

Designed for air washing and cleansing in public buildings and industrial plants, where the greatest possible cooling effect by evaporation is desired.

### **BRAEMER HUMIDIFIERS & DE-HUMIDIFIERS**

Designed for use in connection with humidifying, de-humidifying and low temperature drying installations for industrial processes of all descriptions.

### **BRAEMER SYSTEM OF AUTOMATIC HUMIDITY CONTROL**

May be readily applied to the various types of Webster Air Washers and Braemer Humidifiers and De-Humidifiers.

Perfect in principle and accurate in operation among the distinguishing features may be mentioned:

1. Independent of unequal air and spray distribution and temperature, ordinarily causing unequal humidification, supersaturation, inaccurate results, etc.
2. Quick response—the chief controlling thermostat subject to water, a medium with four times the specific heat of air.
3. Inherently safe against over-humidification.

**Consult us regarding Air Conditioning Apparatus for any purpose.**

*Catalogue sent upon request.*



# AMERICAN BLOWER COMPANY

DETROIT, MICHIGAN

Manufacturers of Heating, Ventilating, Cooling, Purifying, Humidifying, Drying, Mechanical Draft and Blast Equipment; Vertical Self-Oiling Steam Engines, Steam Traps; Fans and Blowers for All Purposes



Fig. 1

**"Sirocco"**  
TRADE MARK

## SYSTEM OF PURIFYING, COOLING AND HUMIDIFYING

For Purifying and Humidifying air in Schools, other Public and Semi-Public Buildings.

For Humidifying and Cooling air in Textile Mills, Macaroni Drying Plants, Printing Houses, and other industrial plants.

For Dehumidifying and Cooling in Candy Factories, Bakeries, Photo Film Drying Rooms, Blast Furnaces, Electric Generators, etc.

Capacities from 3,500 C. F. M. to 350,000 C. F. M.

Write for "detail" information.

Fig. 1 shows "Sirocco" Air Purifier, Cooler and Humidifier.

## MULTI-BLADE FANS AND BLOWERS

For Heating, Ventilating and Cooling in Public, Office, Industrial and Educational Buildings.

For Drying and Mechanical Draft.

Sirocco Multi-Blade Fans will handle more air consuming less power than the ordinary steel plate fan, having twice the wheel diameter.

Built with capacities of from 75 C. F. M. to 1,000,000 C. F. M.

Complete specifying information at your request.

Fig. 2 shows "Sirocco" Multi-Blade Fan for Pulley, Motor or Engine Drive.

Fig. 3 shows "Sirocco" Multi-Blade Fan Wheel.



Fig. 2



Fig. 3

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## "ABC" EXHAUST FANS FOR EXHAUSTING AND CONVEYING SYSTEMS

Exhaust shavings, dust and refuse from wood-working plants.

Take away the dust from emery grinders, buffing and polishing wheels.

Remove smoke and gases from forge fires.

Exhaust the dust from cement plants, flour mills and similar plants.

Remove steam and vapor from vats and kettles in breweries, packing houses, textile and rubber factories.

Elevate and convey cotton and wool in textile mills.

There is a size and type to meet any requirement.

Capacity tables and complete data sent on request.

Fig. 4 shows Type "E" Fan for pulley drive. This and other types are furnished also with direct connected motors.



Fig. 4



Fig. 5

## TYPE "P" SPECIAL STEEL PRESSURE BLOWERS FOR FURNACE AND CUPOLA SERVICE

For supplying draft to Oil and Gas Furnaces; Cupolas; Sintering, Smelting and Pulverized Coal Machines.

For blowing scale from dies in drop forge plants.

Bearings being on independent foundations preclude vibration in the housings. Built to discharge at any angle, against pressures from 1 to 24 ounces.

Ask for complete working data.

Fig. 5 shows Type "P" Special Steel Pressure Blower.

# AMERICAN BLOWER COMPANY

BRANCH OFFICES

ATLANTA, BOSTON, CHARLOTTE, N. C., CHICAGO, CLEVELAND, COLUMBUS, O., DALLAS, DENVER, DES MOINES, EL PASO, TEX., GRAND RAPIDS, MICH., INDIANAPOLIS, KANSAS CITY, LOS ANGELES, MINNEAPOLIS, NEW ORLEANS, LA., NEW YORK, PHILADELPHIA, PITTSBURGH, ROCHESTER, SAN FRANCISCO, SALT LAKE CITY, SEATTLE, ST. LOUIS, with works at TROY, N. Y., and CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO.



## "ABC" VERTICAL, SELF-OILING STEAM ENGINES

Type "A"—Single Cylinder—Engines develop up to 60 H. P. For school or other work where steam pressure is limited to 30 pounds—advocate Type "A" Low Pressure Engines, develop up to 40 H. P.

Type "E"—Double Cylinder—Engines develop up to 120 H. P. This engine is advantageous where more than 40 H. P. and fairly high rotative speed are required and only small space available.

Type "X"—Compound—Engines develop up to 120 H. P. This compound engine is a very conservative steam consumer for H. P. developed. Same space requirements as for Type "E."

*Complete information on all types at your request.*

Fig. 6 shows "ABC" Engine direct-connected to dynamo for generating electric current.

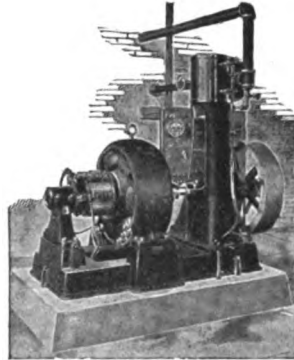


Fig. 6

## "DETROIT" AUTOMATIC STEAM TRAP SYSTEMS

Return, Non-Return, Vacuum, Metering, Lifting and Combination.

For all steam systems under all pressures.

The hot condensation is returned direct to the boiler automatically—at a temperature nearly equal to that at which it is condensed.

A few applications—Lumber Dry Kilns; Brick Tunnels; Vacuum Fans; Steam Cooking Kettles; Laundry, Veneer and Paper Machines (Heating Systems—Gravity Return—Vacuum); Vulcanizers; Hot Rolls, etc.

Any condensation handling problem can be economically solved by the use of "Detroit" Traps.

*Let us send you full data.*

Fig. 7 shows "Detroit" Automatic Return Trap.

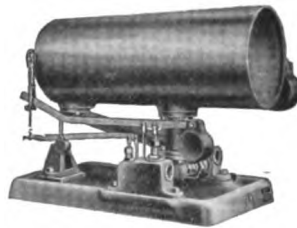


Fig. 7

## TYPE "V" UNIVERSAL BLOWERS AND EXHAUSTERS

Four angles of discharge right hand drive and four angles of discharge left hand drive can be made from one Type "V" Universal Fan (aside from various angular discharges). For all Blowing and Exhausting work requiring up to four ounces pressure. Built for either pulley or motor drive.

*Write for latest Bulletin.*

Fig. 8 shows Type "V" Bottom Horizontal, Right Hand Universal Fan. Pulley drive.



Fig. 8

## "VENTURA" DISC VENTILATING FAN

For delivering large volumes of air at low pressure or against small resistances.

Low price—Small power consumption and inexpensive to install.

For Ventilating rooms and buildings—Ventura, motor driven, ventilating fans 650 C. F. M. to 17,500 C. F. M.

For ventilating small mines or at any mine where a disc fan can be used—engine or motor driven—from 12,000 C. F. M. to 100,000 C. F. M. resistance not to exceed 1" W. G.

*Write for complete information.*

Fig. 9 shows Ventura motor driven ventilating fan.



Fig. 9

## DICKS, SLOSSON CO., INC.

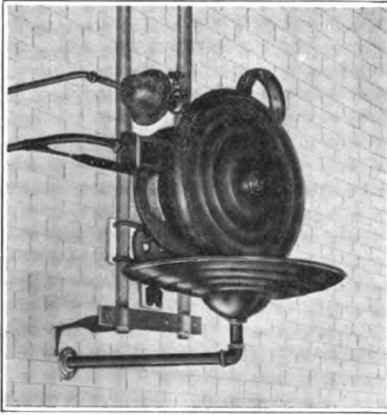
Northern Agents

302 BROADWAY, NEW YORK

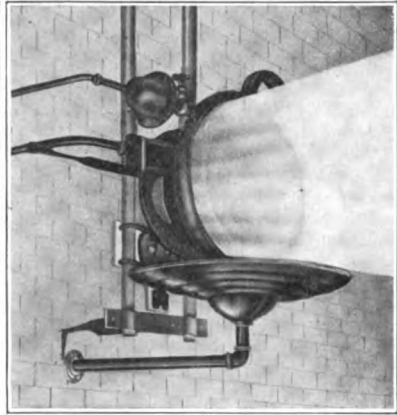
Factory: NORMALAIR COMPANY

Winston-Salem, N. C.

### THE NORMALAIR HUMIDIFIER



**At Rest**



**In Operation**

- Each Humidifier complete in itself.
- Each automatically controlled.
- Electric or belt drive.
- High evaporative efficiency. No precipitation.
- A system of ventilation, without disagreeable drafts.
- A temperature regulator.
- Each machine will humidify 15,000 to 20,000 cubic feet of air space.
- Will automatically control humidity in this space.
- Fan insures circulation of air.
- Uses water at any temperature or pressure from most convenient source.
- Occupies no floor space.
- Installed directly in the room to be humidified, on swivel brackets or ceiling hangers.
- Simple in construction.
- Nothing to get out of order.
- Easily installed.
- Low cost of operation.
- Efficient. Dependable. Automatically controlled.
- Motors supplied for any electric current. Belt driven if desired.
- In use in Textile Mills, Tobacco, Cigar, Cigarette Factories, Shoe Factories, Tanneries, Bakeries, Offices, etc.
- Catalogues and special information supplied.
- Our research, experimental and service departments in charge of competent engineers are at your disposal.



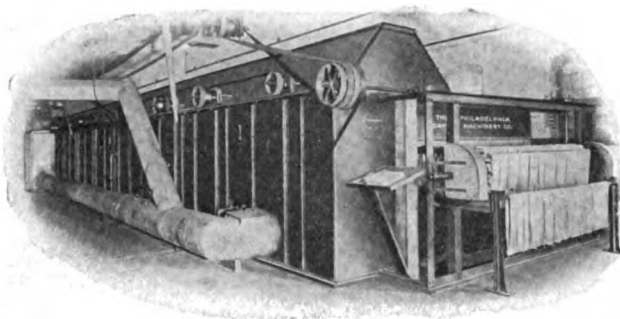
## THE PHILADELPHIA DRYING MACHINERY CO.

MAIN OFFICE AND WORKS, PHILADELPHIA, PA.

BOSTON OFFICE: 53 STATE ST.

Manufacturers of Dyeing, Bleaching and Drying Machinery

Automatic  
Yarn  
Drying  
and  
Conditioning  
Machine



PRESSES { Hydraulic and  
Power-Screw

### BLEACHING AND DYEING MACHINERY

Complete Dyeing, Bleaching, Finishing, and Drying Equipments for Hosiery, Toweling and Underwear.

Circulating Dyeing Machines  
For all kinds of Skein Yarn, Braid,  
Tape and Raw Stock.

Rotary-Circulating Dyeing and  
Bleaching Machines for Hosiery give  
The Best Dyeing at the Least  
Expense.

*Complete information  
and descriptive catalogs  
sent upon request.*

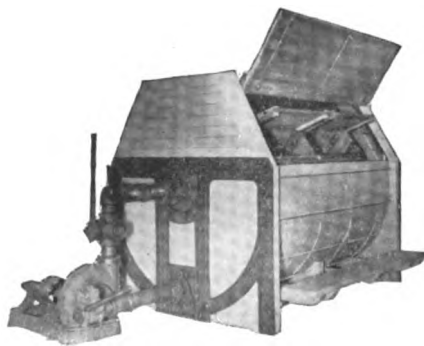
### "HURRICANE" DRYERS

"Hurricane" Drying Machinery also includes: Automatic Loop Dryer for Underwear, Toweling, Piece Goods, Plushes; Automatic Raw Stock Dryer for Wool, Cotton, Linters, Hair, Flax; Continuous Piece Carbonizing Machine; Automatic Yarn Dryer, Truck Dryer for Yarn or Dyed Cones, Automatic and Drawer Type Hosiery Dryers.

Also Automatic and Truck Dryers for all forms of fibres and fabrics, leather, fibre board, tobacco, as well as fruits and chemicals; also Special Dryers for any material which can be dried with heated air.

Built in many standard sizes for any desired capacity. Write for illustrated catalogs.

State Material and Quantity.



Rotary-Circulating Dyeing and Bleaching Machine

# SWENSON EVAPORATOR COMPANY

945 MONADNOCK BLDG., CHICAGO, ILL.

Cable Address—EVAPORATOR CHICAGO

**Evaporation Engineers—Manufacturers of Single and Multiple Effect Evaporators, Vacuum Pans, Beet Sugar Machinery, Paper Pulp Machinery, Leaching Batteries, Heaters and Special Apparatus for Removing Large Quantities of Water from Dilute Solutions**

A MULTIPLE EFFECT EVAPORATOR offers the only economical way of removing large quantities of water with exhaust or live steam. The economy is directly proportional to the number of effects, *i. e.*, a triple effect will remove *three times* as much water with one pound of steam as can be boiled off in an open tank and also permits the use of exhaust (2-3 lb. pressure).

SWENSON EVAPORATORS are handling practically every solution concentrated in commercial quantity, some of the products being in the following list:

Glue	Sugar	Potash Salts	Black Liquor
Gelatine	Glucose	Caustic Soda	Sulphite Waste
Glycerin	Steepwater	Iron Sulphate	Nicotine
Tankwater	Distillery Waste	Common Salt	Sorghum Syrup
Beef Extract	Milk Sugar	Calcium Chloride	Tartaric Acid
Garbage Water	Malt Extract	Sodium Nitrate	Acetate of Lime

*A large part of our present business consists of evaporators for polish and for coal-tar products. For polish alone we installed over twenty large plants before the end of 1916.*

We build several types of evaporators, among them being the following: 1. **Standard Swenson Horizontal Removable Tube Machines** for straight concentration—this type being used for most free boiling solutions; 2. **Patented Basket Type Evaporators** for crystallizing solutions and for bad scaling materials; 3. **Standard Vertical Tube Pans**; 4. **Special Evaporators** made of lead, aluminum, bronze—also with interior surfaces coated with some protective material that is acid-resistant, such as cement, paint, tile or brick; 5. A Special Type—semi-film, for foamy liquors; 6. A New Type for working under high pressure for high concentration, etc.

Each of these designs has a particular field and our long experience in evaporator specialization has resulted in the accumulation of data that enables us to work out any problem.

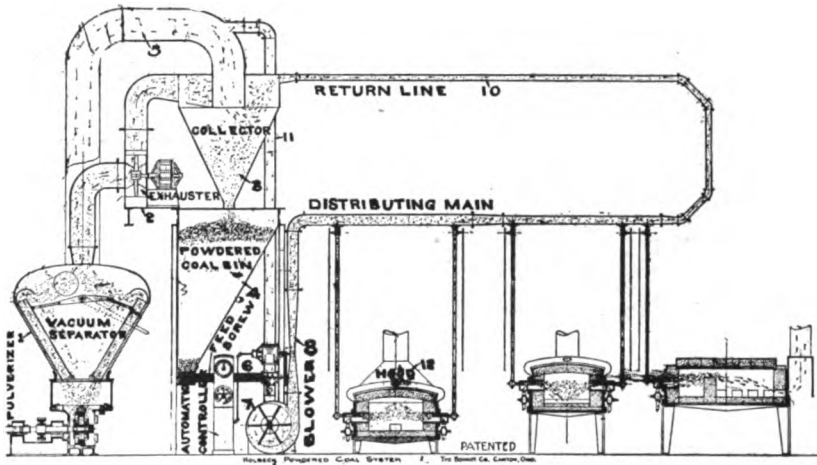
Let us send you a partial list of our customers and explain why we are getting all the business from the largest users of evaporators, some of whom have bought from thirty to forty machines. When writing, send as many details in connection with your work as you have available so we can submit blue prints, etc.

Largest builders of evaporators in America.  
Over 800 installations—20 years' experience.

# THE BONNOT COMPANY

CANTON, OHIO

Manufacturers of Clay Working and Portland Cement Machinery  
Holbeck System Pulverized Coal Equipment



369

Sectional View Pulverized Coal Distributing System

## HOLBECK SYSTEM OF AIR DISTRIBUTION WITH AUTOMATIC REGULATION

FOR HEATING PLATES, BILLETS, INGOTS, FORGINGS, RIVETS, BOLTS, ETC.,  
AND OTHER INDUSTRIAL PURPOSES.

## PORTLAND CEMENT MACHINERY

INCLUDING ROTARY KILNS, ROTARY DRYERS, PULVERIZERS, TUBE MILLS,  
BALL MILLS, ETC.

## BRICK AND TILE MACHINERY

DRY PANS, WET PANS, PUG MILLS, MIXERS, CLAY SCREENS, BRICK MA-  
CHINES, TILE MACHINES, BRICK CUTTERS, TILE CUTTERS.

## BONNOT PULVERIZER

FOR GRINDING LIMESTONE, PHOSPHATE ROCK, COAL, ETC., EITHER WITH  
OR WITHOUT AIR SEPARATOR.

## BALL MILLS FOR GRINDING ORES

## SPECIAL MACHINERY

FOR CHEMICAL PURPOSES, OIL REFINERIES AND OTHERS.

# WILLIAMS PATENT CRUSHER AND PULVERIZER CO.

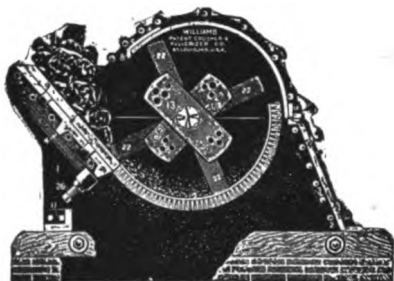
OLD COLONY BLDG., CHICAGO

BRANCH OFFICES: NEW YORK, SAN FRANCISCO, PHILADELPHIA, PITTSBURGH,  
CLEVELAND, DETROIT, RICHMOND, VA.

WORKS: ST. LOUIS

Manufacturers of Crushing and Grinding Machinery

## COAL CRUSHERS FOR COKE OVEN WORK, BY-PRODUCT AND BEEHIVE OVENS



By the use of the Williams Patent Hammer Crushers with the various adjustable features, the following results are obtained from the ovens: The oven pulls easier, more coke is made from each oven, the ash is reduced, the coke comes out firm, regular in size, does not crumble, and the structure is much improved.

The substantial construction of these machines is plainly shown in this cut; all parts subject to wear are easily adjustable, which includes the hammers, the discs, the cage bars, and the breaker plates. The housing is entirely protected from wear by heavy liner plates made of heavy chilled iron. The machine is very accessible, as it is made of sectional construction.

### SPECIFICATIONS REGULAR CRUSHER

Size Mill	Hopper Opening	Size Feed	Capacity Tons per Hour			Speed R.P. M.	Size Pulley		Extreme Dimensions			Horse Power	W'ght P'nds
			1/2" & finer	3/4" & finer	1" & finer		Dia.	Face	L'gth	W'th	H'ght		
1	15x12		30-40	25-30	20-25	1000	20"	15"	6'	6'6"	3'9"	20-25	6500
2	20x12		45-55	40-50	30-40	1000	20"	15"	6'	7'6"	3'9"	30-35	7500
3	30x16		65-80	60-70	45-60	1000	20"	15"	6'	8'6"	3'9"	50-60	9500
4	40x18		100-115	80-90	60-80	1000	24"	18"	6'	9'0"	3'9"	75-80	10500
5	50x20		120-140	100-110	75-100	1000	24"	20"	6'	9'6"	3'9"	100	12000
6	60x20		150-175	115-130	100-120	1000	24"	22"	6'	11'0"	3'9"	125	16200

### JUMBO SPECIFICATIONS

5	30x24		150-175	120-140	80-100	750	24"	18"	8'10"	9'	5'4"	85-100	20000
6	36x24		180-200	145-165	120-140	750	30"	20"	8'10"	10'	5'4"	140-150	24000
7	48x30		225-250	200-220	150-175	750	30"	24"	8'10"	11'	5'4"	165-185	28000
8	60x30		275-300	250-275	180-200	750	30"	24"	8'10"	13'	5'4"	200-250	30000

### CRUSHERS FOR ANTHRACITE MINE REFUSE

Our Patent Hinged Hammer Débris Crushers are in extensive use for properly crushing and treating Anthracite débris or Culm before flushing it into the mines.

### CRUSHERS FOR CHAIN GRATES OR STOKERS

The Williams Patent Coal Splitter takes Run of Mine Coal and reduces the same to 1 1/2", 1 1/4", 1", 3/4" and finer with the "minimum amount of fine dust," the only machine made that can be regulated to properly size coal. All parts are adjustable to wear; the crusher is also adjustable to give most any size coal desired.

### BRIEF SPECIFICATIONS

No. of Crusher	Hopper Opening, Inches	Weight	Horse Power	Capacity—Tons Per Hour R.O.M. to 1 1/2" and Finer
1	15x12	6500	15 to 20	25 to 40
2	20x12	7200	20 to 25	50 to 60
3	30x16	9500	40 to 50	75 to 100
4	40x18	10500	60 to 75	100 to 125
5	50x20	12000	85 to 100	135 to 175
6	60x20	16200	100 to 125	180 to 220

We also crush Coal and Pitch for Briquette Plants—for Coal Washers, before and after washing, and make a specialty of sizing Coal for all Commercial Purposes.

# WILLIAMS PATENT CRUSHER AND PULVERIZER CO.

## RAW MATERIAL GRINDERS FOR CEMENT AND GYPSUM PLANTS

### UNIVERSAL MILL

This *Universal Grinder* is the *only* machine of its kind made. Will take DRY 2" Limestone, Shale, Clay, or Coal, and deliver at one operation a product 95% through 20 mesh, TUBE MILL FEED WITHOUT OUTSIDE SCREENS OR SEPARATORS. *No other machine* can deliver the fine uniform product year in and out.



### COMPLETE SPECIFICATIONS UNIVERSAL MILLS

Size Mill	Size Feed	Diam. Mill	Capacity Per Hour		Speed	Horse Power	Floor Space Extreme Dimensions			Size Pulley		W'ght
			Dry	Stone								
			12 Mesh	20 Mesh	R.P.M.		L'gth	Width	Height	Diam.	Face	P'nds
0	1"	18"	2-4	1-3	1800	10-12	5'	5' 1"	3' 2"	8"	8 1/2"	2500
1	1 1/2"	26"	2-4	1-3	1600	15-20	6' 3"	5' 10"	3' 8"	16"	10 1/2"	4000
2	1 1/2"	26"	5-6	3-5	1600	20-25	6' 3"	6' 3"	3' 8"	16"	12 1/2"	5000
2xx	2"	26"	6-8	5-6	1600	30-35	6' 3"	7'	3' 8"	20"	15"	6500
3	2"	40"	10-12	8-10	1100	50-60	7' 6"	6' 10"	5' 4"	20"	15"	12000
4	2 1/2"	40"	13-15	10-13	1100	65-75	7' 6"	7' 10"	5' 4"	20"	18"	14000
5	2 1/2"	40"	16-20	15-18	1100	80-100	7' 6"	8' 6"	5' 4"	20"	20"	16500
9	3"	60"	25-35	20-30	750	150-175	12'	9' 2"	7' 2"	30"	24"	30000

### VULCANITE RE-CRUSHER

These Vulcanite grinders will take raw material, limestone, shale, clay or coal in cubes of 3 inches and under, and reduce the same to 1/2 inch or 1/4 inch. This makes an excellent feed for those plants which use roller mills as finishers in the raw end.

### VULCANITE SPECIFICATIONS

Size Mill	Hopper Opening	Size Feed	Capacity Tons per Hour			Speed	Horse Power	Extreme Dimensions			Size Pulley		W'ght
			1/2"	3/4"	1"			L'gth	Width	Height	Diam.	Face	
1	14" x 5"	1 1/2"	4	3	2	1500	15-18	4' 8"	6' 3"	3' 3"	16"	10 1/2"	4200
2	18" x 6"	2"	7	5	3	1500	20-25	4' 8"	6' 6"	3' 3"	16"	12 1/2"	5000
2xx	24" x 6"	2"	10	8	6	1500	30-35	4' 8"	7'	3' 3"	20"	15"	6000
3	18" x 8"	2 1/2"	20	18	15	1000	40-50	5' 2"	7'	4'	20"	15"	10000
4	24" x 8"	3"	30	27	25	1000	70-75	5' 2"	7' 4"	4'	20"	18"	12000
5	30" x 8"	3"	35	30	28	1000	90-100	5' 2"	8'	4'	20"	20"	14000
6	38" x 10"	3"	40	35	30	1000	110-125	5' 2"	9'	4'	20"	22"	15500
7	40" x 10"	3"	50	42	35	1000	125-150	5' 2"	9' 6"	4'	22"	24"	17500

We issue the following catalogs:

No. 45-E, Coal Crusher Catalog—For all those crushing and grinding coal, etc.

No. 45, Cement and Limestone Catalog—Limestone, Gypsum and Similar Grinders.

No. 45-B, Fertilizer Catalog—Bone, Tankage, Shells and Fertilizer Work.

No. 45-A, Clay Catalog—Clay, Shale, etc., for Brick, Tile and Terra Cotta.

No. 45-C, Oil Cake Catalog—Linseed, Cottonseed and Similar Oil Cake Grinders.

No. 45-F, Shredder Catalog—Bark, Chips, Cork and all Fibrous Materials.

No. 45-D, Stock Food Catalog—All Cereals for Feed Millers, Alfalfa, etc.

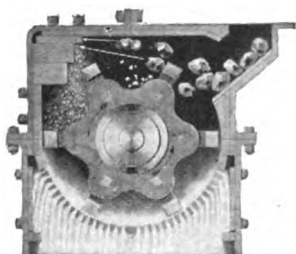
Mention material you wish to crush or grind and we shall see that you receive the proper catalog and specifications.



# K-B PULVERIZER COMPANY, INC.

86 WORTH ST., NEW YORK CITY

Manufacturers of K-B Pulverizer; Complete Equipment for Crushing Plants; Jaw Crushers; Magnetic Separators; Screens; Elevators



## THE K-B PULVERIZER

is an all-steel hammer-mill, designed for the intermediate crushing of moderately hard materials.

It is used in cement mills on the "raw" side, in lime plants to prepare lime for the hydrators, and in quarries and on the farm to reduce limestone for use in agriculture. It will also handle coal, gypsum, oyster-shells, fluorspar, feldspar, phosphates, and other similar materials.

### Features of K-B Construction and Design



**ALL-STEEL FRAME**—to withstand severest service.

**MANGANESE STEEL LININGS**—protect frame against wear.

**U-TYPE HAMMERS**—reduce power consumption by concentrating weight at point of impact with incoming material.

**PATENT HAMMER ADJUSTMENT**—takes up wear, increases hammer life; maintains capacity; insures uniform product.

**SCREENS**—can be adjusted for any size product and can be changed without difficulty in a few minutes by one man.

Catalog on request. Plans furnished for complete crushing plants.

### TABLE OF CAPACITY AND POWER

This table can give only approximate figures, as they vary considerably according to the hardness of the material, its moisture, size of feed, etc.

If you will send us a small sample of your material we will gladly give you more exact figures.

Approximate Capacity				Approximate Power
	SIZE OF PRODUCT			
	$\frac{1}{4}$ "	10 mesh	20 mesh	
K-B No. 1	Tons per Hour	Tons per Hour	Tons per Hour	
Stone	5-8	4-7	3-6	12-15 H. P.
Coal	7-10	6-9	4-7	12-15 H. P.
Lime	11-15	10-14	7-10	12-15 H. P.
K-B No. 2				
Stone	14-17	13-16	8-12	25-30 H. P.
Coal	18-21	17-20	13-16	25-30 H. P.
Lime	22-27	20-25	15-20	25-30 H. P.

Dimensions of larger sizes submitted on application.

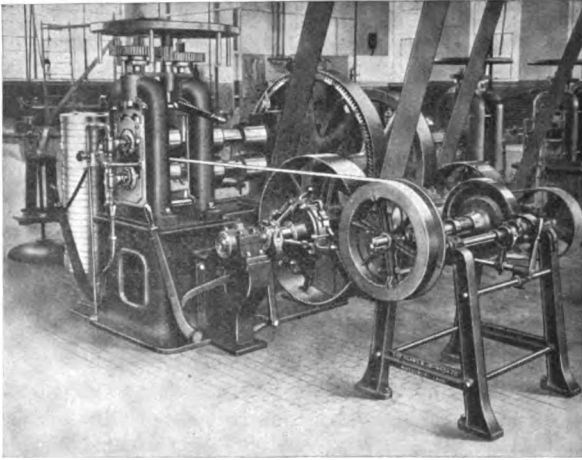
# THE BLAKE & JOHNSON COMPANY

Established 1849

MACHINERY DIVISION  
WATERBURY, CONN.

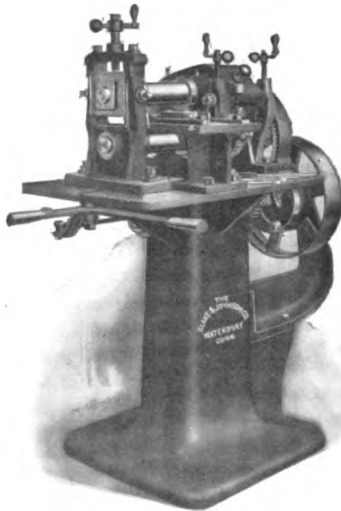
## COLD ROLLING MACHINERY

For Steel, Brass, Copper, Etc.



373

BUILDERS  
OF  
SLITTERS



SPECIALISTS  
IN  
MACHINERY  
FOR  
MANUFACTURING  
METALS  
IN  
THIN GAUGES

## **THE TORRINGTON MFG. CO.**

Incorporated 1885

TORRINGTON, CONN., U. S. A.

**Rolling Mill Machinery, Tube Drawing Machinery, Wire Drawing Apparatus,  
Cabling and Stranding Machinery, Special Machinery, Contract Work, Etc.**

---

### **ROLLING MILL MACHINERY**

For brass, copper, aluminum, sterling and German silver, zinc, bronze, steel—  
or other cold rolling and finishing.

For sheets, strips or plates; also rods. Flatteners, straighteners, coilers,  
slitters, shears, drying machines, scouring machines, saws, mills, stretching  
machines, rolls, overhauling machines, mill trucks, blockers, etc.

### **TUBE DRAWING MACHINERY**

For tubes and pipes of brass and copper or other ductile metals. Draw benches,  
straighteners, cutting-off saws, testing benches, pointers, die grinders, etc.

374

### **WIRE DRAWING MACHINERY**

For wire and rods. Bull blocks, draw benches, air hoists, threshing barrels,  
die stringing machines, continuous wire machines, fine wire machines, flat wire  
mills, trolley wire machines, rolls, straighteners, spooling machines, magnet  
wire machines, pointers, etc.

### **CABLING AND STRANDING MACHINERY**

For twisting or stranding individual wires into finished cables, electrical  
conductors and wire rope. Twisters, twinners, stranders, capstans, spoolers,  
take-ups, take-offs, etc. Machinery for cables ranging from 2 to 91 wires.

### **SPECIAL MACHINERY FACILITIES**

For satisfactorily producing special machines, from design to assembly. Draft-  
ing room, pattern shop, machine shop, forge shop. Screw machine, turret  
lathe and grinding departments. Buildings of modern construction. Excep-  
tional attention to accuracy and privacy. Workmanship and material guaranteed.

### **CONTRACT AND JOBBING WORK**

Of every description.



# SLEEPER & HARTLEY, INC.

WORCESTER, MASS.

COATICOOK P. Q., CANADA

Designers and Builders of High-Speed Automatic Wire Coiling Machinery



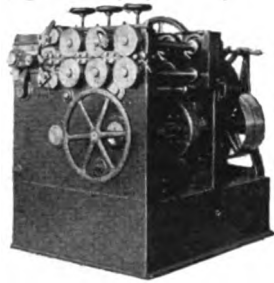
UNIVERSAL  
SPRING  
COILING  
MACHINES

Amongst the forty-odd, standard, spring makers' machines offered the trade for spring and wire coiling, spring setting, spring hooking, spring knotting, etc., the series of UNIVERSAL SPRING COILING MACHINES should be noted especially.

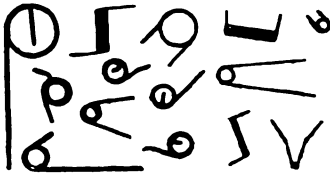
The machines of this type are designed to make complete, AND WITHOUT ANY TOOL CHARGE, all kinds of open-and-close-coiled wire springs. Right- or left-hand springs; straight, barrel-shaped, or tapered springs; and springs with coned ends, or squared ends, can be produced.

The normal equipment of each machine is such that it will take, without change, all the wire sizes within its range; and will produce all the spring forms within its capacity, by merely shifting and adjusting the various working members.

These machines are now built in eight sizes, and are adapted to handle OIL TEMPERED WIRE from .004" to  $\frac{3}{4}$ " diameter.



No. 3 Universal Coiler



TORSION  
SPRING  
WINDING  
MACHINES

These machines are built in four sizes, handling OIL TEMPERED WIRE from .010" diameter to  $\frac{3}{4}$ " diameter.

These machines operate automatically.

Spring forms may be wound right or left hand, and the lengths and angular relations of the projecting ends may be varied as desired; one end may be put across the coil; and in some cases bends may be made in the projecting ends.



Torsion Spring Machine

## WIRE NAIL MACHINES

These machines are a new development. Though small and compact, they are very powerful, the moving members operating in mechanical balance with ease and smoothness, at exceptionally high speeds.

No rotating cams are used—all the working motions being accomplished by means of toggle joints—with a practically noiseless result.

The power is expended in making nails—not noise—and the consequent wear and tear upon the machine is enormously reduced.

The pointing and heading operations are separated, the heating effect upon the dies being thereby greatly reduced, and the working stresses much more widely distributed.

Other notable features are the accessibility of these dies, and the manner in which their adjustment is accomplished; compensating wedges are provided to take up wear throughout the machine.

These machines are built in five sizes, handling wire from No. 17 (.054") to  $\frac{3}{4}$ ", and making nails from  $\frac{3}{4}$ " to 10" in length.



Wire Nail Machine

In addition to the machines described or mentioned above, we offer the following:  
HIGH SPEED WIRE STRAIGHTENING AND CUTTING MACHINES (IN FIVE SIZES).

MUSIC WIRE STRAIGHTENING AND BUNDLING MACHINES (2 SIZES).

TUNGSTEN FILAMENT COILING MACHINERY.

FLEXIBLE SHAFT COILING MACHINES.

FLEXIBLE CASING COILERS.

FLEXIBLE METALLIC TUBE COILING MACHINES (IN 2 SIZES).

DOUBLE POINT TACK MACHINES., ETC., ETC.

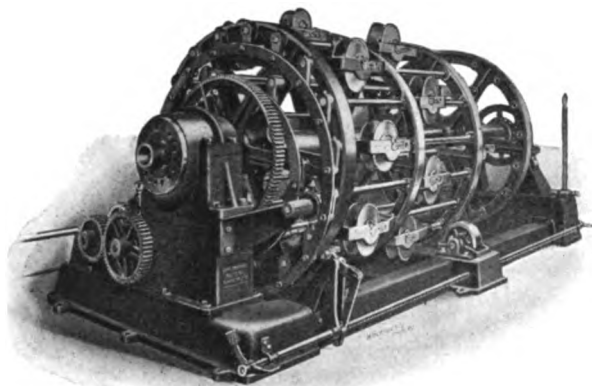
## **NEW ENGLAND BUTT COMPANY**

PROVIDENCE, R. I.

European Agents: Selson Engineering Company, Ltd., LONDON, ENGLAND.

**Manufacturers of Braiding Machinery; Machinery for Insulating Wires and Cables, also Machinery for the Manufacture of Wire Ropes and Cables**

### **WIRE ROPE MACHINERY**



**Planetary Type Cabling Machine**

Full line of high speed and planetary type machines. Closing Machines for wire rope.

### **BRAIDING MACHINERY**

Used for making plain and fancy braids for dress trimmings and millinery, round and flat shoe laces, soutache braids, candle wicking, tapes, cords, banding, clothes lines, fish lines, packing, gas tubing and rubber hose, round and flat elastic.

Sash Cord Braiders for making solid sash and curtain cord of various sizes.

Sash Cord Finishers for polishing solid sash cord.

Silk Covering Machines for covering cotton with silk.

Rubber Spreading Machines, built of any desired width for applying a thin coating of rubber to cloth.

### **INSULATING MACHINERY**

#### **Single, Double and Triple Deck Braiders**

These are made in all sizes and combinations for covering wires from small sizes up to large cables.

Magnet Wire Machinery for silk and cotton covering arranged to handle round and flat wires.

Annunciator Wire Winders, Single, Double or Triple Deck.

Taping Machinery for taping wires or cables with paper or other materials.

Polishing Machines, for insulated wires and cables from the small sizes up to 3' cables.

Wire Measuring Machines.

Twinning Machines.

Rubber Strip Covering Machines, for applying rubber insulation to wires and cables with either single or double seam. These machines are built in several sizes and handle from one up to twenty wires at a time.

# **TEXTILE MACHINE WORKS**

**READING, PA.**

**Manufacturers of Braiding and Insulating Machinery**

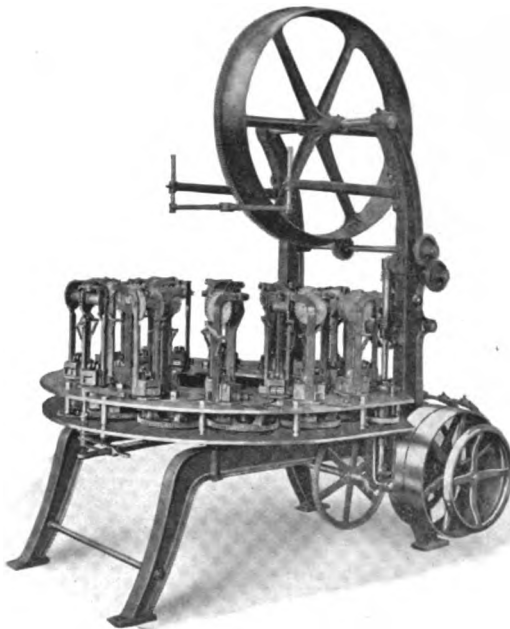
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## **HIGH GRADE BRAIDING MACHINES**

for

**Electrical Wires and Cables**

**and for making and armoring Rubber Hose**



**21 Carrier Steel Wire Braider with 12" Horn gears**

**Packing Braiders**

**Take-up Fixtures**

**Annunciator Wire Winders**

**Rubber Strip Covering Machines**

**Winders and Doublers**

**Measuring Machines, Etc.**

---

**HIGH GRADE GRAY IRON CASTINGS**

## UNION DROP FORGE COMPANY

358 WEST GRAND AVE., CHICAGO, ILL.

**Manufacturers of Drop Forgings and Ground Crankshafts**

---



### **COUNTERBALANCED CRANKSHAFTS**

**Drop-Forged  
In One Piece**

We are prepared to furnish Drop Forged Crankshafts with Counter Weights forged integral either in one or multiple cylinder shafts. Crankshafts forged by our process eliminate the possibility of the Counter Weights becoming loose or flying off which might occur if the Counter Weights are not forged integral (from one bar). We can forge and finish complete your Crankshafts as we operate a large Grinding Department in conjunction with our Forge Department, which will save you delay and expense, in that the forging is produced and finished in the same plant.

All steel received at our Works, either Simple Forging or Alloy, is systematically and carefully analyzed by Chemists of National Repute and our Heat Treating Department is under the most competent management. We, therefore, are prepared to furnish you Economically the best Crankshaft it is possible to produce.

This statement will apply to all Drop Forgings made by Union Drop Forge Company requiring Accuracy, Quality of Steel and proper Heat Treating.

# WORCESTER PRESSED STEEL CO.

Factory and Main Office

WORCESTER, MASS.

NEW YORK SALES OFFICE  
30 Church St.

CHICAGO SALES OFFICE  
1243 Peoples Gas Building



## HIGHEST QUALITY LIGHT AND HEAVY METAL STAMPING

Deep Drawing, Cold Rolling, Cold Forging, Pressing,  
Electric and Autogenous Welding, Punching, Blank-  
ing, Coining, Embossing, Shearing, Squaring, Machin-  
ing, Annealing, Case Hardening, Tempering.  
Heat Treating, Electro-Plating.

## SHEET METAL PARTS TO ORDER FOR

Automobiles	Motorcycles	Lawn Mowers
Textile and	Bicycles	Roller Skates
Electrical Fittings	Cream Separators	Ice Skates
Vacuum Cleaners	Ball Bearings	Pruners
Shock Absorbers	Calculators	Telautographs
Typewriters	Phonographs	Dictographs
Telephones	Sheet Metal Specialties	Handles
Cold Drawn Mouldings	Pulleys	Bowls
Tubing with Seam	Collars	Guards
Flanges	Bushings	Brake Drums
Brackets	Housings	Axle Boxes
Wrenches	Retainers	Looms
Discs	Cups	Clutch Discs
Caps	Hubs	Transmission Cases
Shims	Cases	Stampings

Our entire organization and equipment, developed by 30 years' experience, are devoted exclusively to making special stamped parts for others from strip and sheet steel, brass, bronze, copper, aluminum, silver, monel metal and the new steel alloys. We make all of our own tools. We pickle, oil, shear and cold-roll our own steel. We make our own case-hardening compounds.

We also have one of the most completely equipped COLD ROLLED STRIP STEEL MILLS in the East, having a capacity of 1500 tons per month and producing strip steel up to 12" in width and from .005" to .375" in thickness.

## L. O. KOVEN & BROTHER

OFFICE: 154 OGDEN AVE., JERSEY CITY, N. J.

N. Y. WAREROOMS  
50 Cliff Street, New York City

WORKS  
JERSEY CITY, N. J.

**Engineers, Manufacturers, Machinists and Designers. We Fabricate Plate Steel, Copper, Brass, Tin, Aluminum, etc., of Any Shape. Designers and Makers of Special Apparatus for Manufacturing Industries**

We are prepared to do plate work of every description for Ships, Mills, Mines, Factories, Plantations, Chemical Works, Paint Works, Paper Mills, Abattoirs, Fertilizer Plants, Water Works, Government Work, Sewage Systems, etc. We also make and design Special Apparatus and Machinery to meet the progress in all lines of business. *We have the facilities for improving yours.*

### A Partial List of What We Make

AIR WASHERS	KILNS
ALCOHOL RECOVERY AND PURIFYING APPARATUS	LEAD LINED TANKS
ALCOHOL STILLs	MALT TANKS
AUTOClaves	METAL MELTING FURNACES
BOTTLE STERILIZERS	MILK MACHINERY
BREAD RACKS	MIXERS
CANS	MUFFLERS
CAN WASHERS	OIL FILTERS
CANNED GOODS STERILIZERS	OIL WASHERS
CHEESE VATS	OYSTER WASHERS
CHINA KILNS	PASTEURIZERS
COIL BOILERS	PERCOLATORS
CONDENSED MILK COOLERS	PIE RACKS
COPPER LINED STEEL TANKS	PIPE (RIVETED)
CREOSOTING TANKS	PLATING TANKS
DIGESTERS	RUBBER LINED TANKS
DRINKING GLASS STERILIZERS	SAND BLAST TANKS
DRYING APPARATUS	SHIPPING DRUMS
EXHAUST MANIFOLDS	SPRAYERS, FRUIT TREES
EXTRACTORS	SPRAYERS, PAINT
FILTER PRESSES	SOLVENT RECOVERY STILLs
FRUIT WASHERS	STEAM KETTLES
GALVANIZED TANKS	STERILIZERS
GASOLINE TANKS	STILLS
GASOMETERS	SMOKE STACKS
GLASS KILNS	TANKS (AIR, GAS, OIL AND WATER)
GLASS STERILIZERS	TUMBLERS
GLUE DISSOLVERS	VACUUM PANS
GUM WASHERS	VARNISH TANKS
HAM BOILERS	VEGETABLE WASHERS
HOT WATER TANKS	VULCANIZERS
HUMIDIFIERS	WASHERS FOR CANNERIES
JACKETED TANKS	WATER STILLs

# MORRISON BROS.

Established 1855

DUBUQUE, IOWA

Steel Tanks for All Purposes

## Hydro-Pneumatic Pressure Tanks, Hot Water Storage Tanks, Air Pressure Tanks

Morrison tanks that are subjected to internal pressure are riveted and brazed. In the brazing process the seam is riveted merely to hold the plates together and the copper brazing compound is sweated or flushed into the seam, forming a perfect bond between the plates. No caulking is required as every minute opening between the plates and around the rivets is completely filled with the brazing compound.

The heads on all pressure tanks are welded as are also the circular seams on long tanks.

For regular work, tanks are tested under air pressure.

## Septic Tanks

Morrison Septic Tanks are welded throughout. They successfully dispose of the sewage problem for homes situated away from regular sewage systems.

## OIL TANKS for Motor Trucks and Wagons

Morrison Tanks to be mounted on trucks or wagons for the transportation of oils are made up of two or more separable compartments. Each compartment is welded and tested separately and then mounted on wooden sills and blocks. The finished tank, complete with bucket box, top-rack or side-racks, is shipped ready for mounting on a truck or wagon.

## Underground Storage Tanks

Morrison Underground Tanks are made of heavy plate, welded throughout and bear the Underwriters' labels.

## Gasoline Filling Station Pumps

Two styles of station pumps are made: the Self-Measuring, which delivers one gallon or any part of one gallon per stroke, and the Visible Pump which is arranged with a 20 gallon feed tank above the pump and is provided with a gauge glass which shows the customer the exact amount of gasoline delivered to his car.

## Morrison Self- Lubricating Tank Wagon Faucets

The Morrison Self-Lubricating Faucet is provided with a chamber for a special lubricant which automatically keeps the plug lubricated, and, on account of its being impervious to oils, prevents leakage.

## Tank Wagon Air Vents

Morrison Double Acting Air Vents are provided with ball valves which automatically permit air to pass into the tank or pressure to be released as required. When used on truck tanks the vent is automatically closed and prevents leakage in case the tank is overturned.

## Station Tank Air Vents

Large air vents are required on station oil tanks to permit air to pass in and out freely when drawing off or filling. Morrison vents are made of brass and are designed to work automatically and easily.

## Automatic Barrel Fillers

The Morrison Automatic Barrel Filler is provided with a float valve which closes automatically when the barrel is filled to the desired point.

## Relief Valves

Morrison valves are made of brass throughout and are provided with means of adjustment to maintain pressure desired. Valves are provided with a lever so that they may be tested daily.

## Special Tanks

Prices of special tanks will be quoted on request.

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# PHOENIX IRON WORKS CO.

Established 1865

MEADVILLE, PA.

Telephone: Bell 3; Meadville 3.

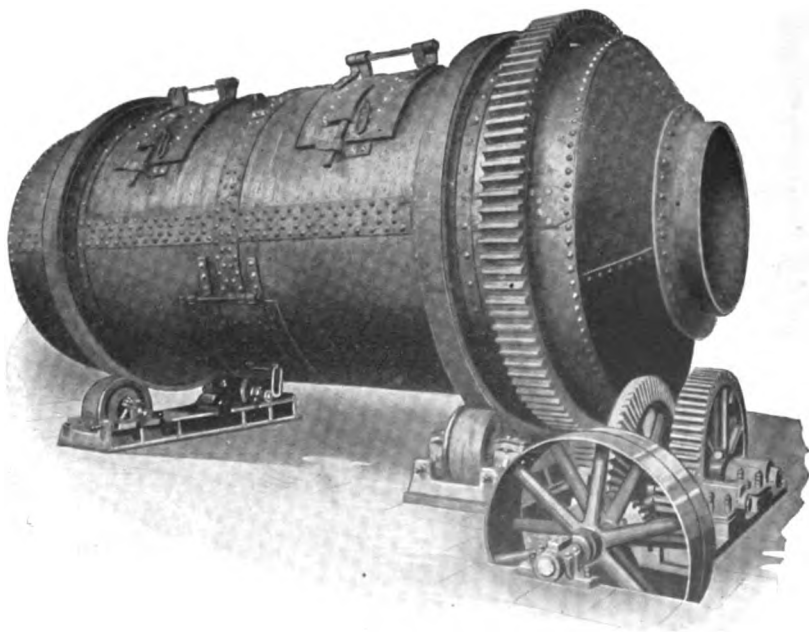
SALES AGENCIES

NEW YORK CITY

PHILADELPHIA, PA.

PITTSBURGH, PA.

SAN FRANCISCO, CAL.



*SPECIAL MACHINERY A SPECIALTY*

Manufacturers of

**BOILERS**

**STACKS**

**BREECHINGS**

**TANKS**

**PLATE WORK—RIVETED & WELDED**

**IRON CASTINGS**

**ENGINEERS & MACHINISTS**

*Inquiries Promptly Attended to*





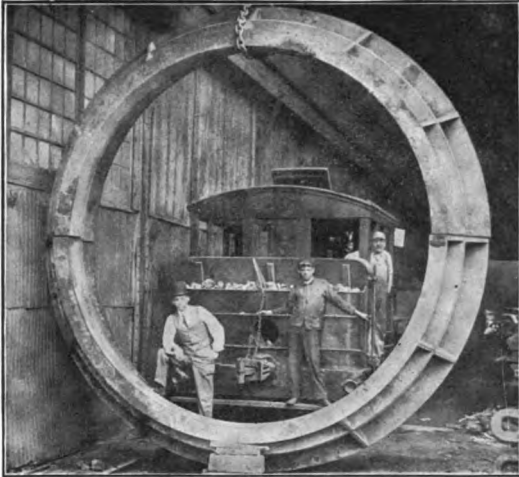
## **THE MARSHALL FOUNDRY CO.**

OFFICE: 1st-2nd NATL. BANK BLDG., PITTSBURGH, PA.

WORKS: JOSEPHINE AND PITTSBURGH, PA.

**Manufacturers of Ingot Molds and Grey Iron Castings**

**CAPACITY 1000 TONS PER DAY**



### **INGOT MOLDS**

made from remelted or direct furnace Standard Bessemer Pig Iron.

### **GREY IRON CASTINGS**

for all purposes—10 lbs. to 40,000 lbs.

### **STRUCTURAL CAST IRON**

Columns, Bases, Treads, Sills, Lintels, Guards, Floor Plates, Trench Plates.

### **HEAVY STONE CRUSHING CASTINGS**

We make a specialty of LARGE CASTINGS such as: OPEN HEARTH, BESSEMER STEEL WORKS and BLAST FURNACE CASTINGS  
BELLS      HOPPERS      EXTENSIONS      TROUGHS  
HEARTH JACKETS      COOLING PLATES  
FURNACE RUNNERS      BLOW PIPES      COLUMNS  
SOAKING PIT COVERS, SOAKING PIT and INGOT CARS  
CINDER and SLAG POTS, LADLES, THIMBLES,  
LININGS; also TINNING POTS  
AIR AND GAS VALVES      GAS PRODUCER CASTINGS

**SPECIAL CASTINGS for CONDENSERS**

**EXHAUST OUTLETS**

**PIPE SECTIONS**

**CHEMICAL POTS, KETTLES, STILLs, PANS, SCREENS,**  
for  
**CHEMICAL, SOAP, GLYCERINE, SUGAR, PAINT, VARNISH**  
and BY-PRODUCT COKE WORKS

### **INGOT MOLDS—SOLID OR SPLIT**

All kinds and sizes, for Bessemer, Open Hearth, or Crucible Steel.

We have on hand PATTERNS and EQUIPMENT for all sizes of MOLDS used in general practice.

## THE PFAUDLER CO.

ROCHESTER, N. Y.

NEW YORK

CHICAGO

SAN FRANCISCO

**Glass Enameled Steel Tanks and Apparatus for Corrosive or Sensitive Liquids**

### **PFAUDLER GLASS ENAMELED STEEL TANKS AND APPARATUS**

include Kettles, either jacketed or plain; Mixing Tanks, with Agitators of various types; Stills, with or without Enameled Condensers; Evaporating Pans, for vacuum or atmospheric pressure; Storage and Car Tanks; and Specially Designed Apparatus.

These are built of open hearth steel, rolled, pressed and welded to shape, and lined with Glass Enamels developed by ourselves, of exceptional resistivity to corrosion, density and tenacity. We fuse our Glass Enamels into the steel at great heat, by the process which we originated over thirty years ago.



**Pfaudler One-Piece Tanks, Kettles, etc.,** are welded throughout by the most highly approved methods, and may be either open or closed, jacketed or plain, with enameled nipples, either flanged or threaded, placed as required.

**Sectional Tanks,** lined with our Resistive Glass Enamels, consist of interchangeable rings and heads, securely bolted together, with joints sealed by gaskets of suitable materials. Because of their practically unlimited capacity and their interchangeability, these sectional tanks are used all over the world for the storage of liquids. In smaller apparatus, a combination of welded and bolted construction often presents desirable advantages.

**Agitators and Other Fittings:** Our Glass Enameled Steel, propeller type agitators are very efficient in corrosive work. For materials which will not attack silver-plated, tinned or plain brass or steel, we build agitators of those metals for single or double motion, in propeller type (with or without drum) or "sweep type," which are very successful. A propeller type agitator set horizontally into the side of a tank near the bottom provides excellent circulation; and we have designed a small, adjustable agitator which can quickly be attached to the rim of an open tank or kettle, and which gives remarkably good results.

Our Enameled Steel Catsup Kettles, equipped with "flash" steam coils, are being successfully used in many prominent preserving plants.

**Uses:** Food Products, such as Soups, Extracts, Sauces and Dressings, Preserved Fruits, Syrups, etc.; Heavy and Pharmaceutical Chemicals; Beverages; Fluid and Condensed Milk; Ice Cream; Sanitary Water Storage; in short, the preparation and storage of almost all liquids and semi-liquids requiring non-corrodible or sanitary containers of large capacity. We also build the Pfaudler Glass Enameled Steel Laundry Chute—absolutely sanitary—for Hospitals, Hotels, etc.

We are the originators and largest manufacturers of Enameled Steel Tanks in the world.

# **AMERICAN TOOL & MACHINE CO.**

Established 1843

Incorporated 1884

BOSTON

---

## **FOX BRASS FINISHERS' LATHES**

Patented and introduced in 1857.

A constantly increasing demand for sixty years.

## **WESTON CENTRIFUGALS**

Patented and introduced in 1864.

First developed for sugar and modified to meet every demand requiring centrifugal process.

5 inch diameter hand power.

10 inch diameter belt or motor for laboratory.

30-36-40 inch for sugar and chemicals.

20 inch diameter drying small pieces

and up to

54 inch diameter hydro extractor.

## **ROPER OIL SEPARATOR**

For saving oil from chips and turnings.

Built for more than forty years with a larger demand than ever.

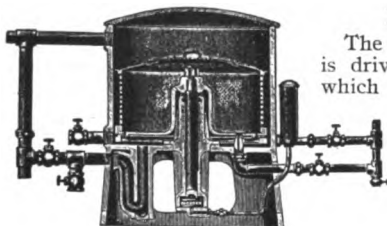
## **BELT KNIFE LEATHER SPLITTING MACHINE**

## **POWER TRANSMISSION MACHINERY**

# THE OIL AND WASTE SAVING MACHINE COMPANY

1509 REAL ESTATE TRUST BLDG., PHILADELPHIA

Manufacturers of Machinery for Separating and Reclaiming Oil and Waste,  
Centrifugal Oil Filters, Oil Extractors for Cleaning Oily Chips



Waste Machine

## IMPROVED WASTE MACHINE

The basket or waste receptable in the machine is driven by direct connected steam turbine, which exhausts into the basket, heating and liquefying the oil and grease, which is extracted from the waste, towels or rags by centrifugal force. The machine is then filled with water, and the waste, towels or rags thoroughly washed and sterilized, after which same is dried by the machine for future use.

Guaranteed saving of 90% of the oil and all of the waste. Requires little attention. Over 3,000 machines in use. Made in 10", 15", 20" and 36" sizes with respective capacities of  $\frac{1}{2}$  cu. ft., 1 cu. ft., 2 cu. ft., and 8 cu. ft. of waste rags or machinery towels per charge.

## TURBINE CENTRIFUGAL SEPARATOR

For Extracting Oil from Metal Turnings

This Machine is steam turbine driven and the heat from the steam coming into contact with the oily chips and turnings, aids the centrifugal action in producing an absolute oil extraction not procured with ordinary belt driven Separators. All belting and countershafting troubles and cares are entirely eliminated.

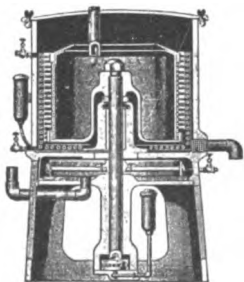
The Basket capacity of this Machine is 8 cu. ft. making it especially adaptable for the handling of long, curly and bushy turnings.



Turbine Centrifugal Separator

## TURBINE CENTRIFUGAL OIL FILTER

Will remove all foreign matter, all moisture or emulsion from and sterilize the oil. Driven by direct connected steam turbine. The filter requires very little steam to operate same, owing to its design and its being equipped with a ball step-bearing; requires little care in operation and has practically no wearing parts.



Centrifugal Oil Filter

### SPECIFICATIONS

Size	15"	20"
Base measurements.....	21" x 21"	27" x 27"
Height.....	30"	40"
Weight.....	450 lbs.	800 lbs.
Steam pressure required to operate..	20 lbs.	40 lbs.
Steam consumed per hour of operation	83 lbs.	138 lbs.
Oil filtering capacity per hour.....	20 to 30 gals.	50 to 60 gals.

# THE EDWARDS MANUFACTURING CO.

Incorporated 1901

306-336 EGGLESTON AVE., CINCINNATI, OHIO

Consulting Engineer & Patentee, **LESTER G. WILSON**, Mem. A. S. M. E.

BRANCH OFFICES AND WAREHOUSES

NEW YORK, N. Y., 81-83 Fulton Street      PITTSBURGH, PA., Oliver Bldg.  
PHILADELPHIA, PA., 1414 Land Title Bldg.      SAN FRANCISCO, CAL., 315-319 Monadnock Bldg.  
BALTIMORE, MD., 7 Clay Street      DALLAS, TEXAS, 1635-37-39 Pacific Ave.

**Manufacturers of Sheet Metal Building Material**

## EDWARDS ROLLING STEEL DOORS AND SHUTTERS

**Rolling Steel Doors** have been designed by this Company's engineer, and successfully constructed for doorways of all sizes up to 40 feet in width, and for openings over 100 feet in height.

**Rolling Shutters** have been designed for windows and skylights. This Company is prepared to manufacture the combination complete, and with wire glass if desired. The rolling shutters are often operated in groups and sometimes by electric motors.



Section of Interlocking Slat

**Types:** Edwards Interlocking Slat Style is constructed of special cold rolled strip steel 22 to 14 gauge. *Bright or Galvanized.* Spring balanced. Handle or chain operation.

This section of slat gives great resistance to wind pressure. It was purchased by the U. S. Government for many buildings in the Panama Canal.

Edwards Corrugated Style is constructed of the best sheet steel procurable for this purpose. *Black or Galvanized.* Spring balanced. Handle or chain operation.

Our sheets have a special shape of corrugation and are fastened together without rivets.



Section of Corrugated Sheet

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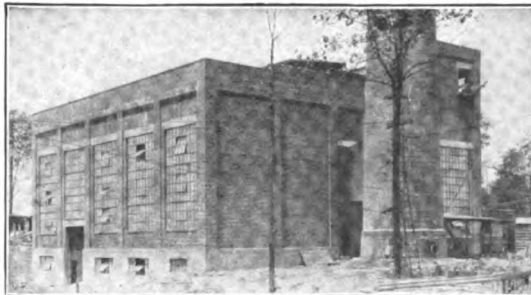
**Special Drawings:** This organization will gladly prepare details and specifications for *all* types of doors and shutters, and so assist owner, architect or engineer to select the best and most economical installation.

**Uses:** Specify Edwards Rolling Doors and Shutters for:

R. R. Shops  
R. R. Roundhouses  
R. R. Freight Sheds  
Express Buildings  
Steamship Docks  
Grain Elevators  
Telephone Exchanges  
Jails  
Banks  
Libraries  
Armories  
Gun Sheds  
Post Offices  
Garages  
Car Houses  
Warehouses  
Factories  
Elevators  
Craneways

Power Plants  
Boiler Fronts  
Transformers  
Subways  
Store Fronts  
Stairways, etc.

Residences during closed seasons  
Federal, County and Municipal Buildings  
Office Buildings, Rear and Court Windows  
Dampers for Heating and Ventilating Systems  
Rolling Partitions for Churches and Schools  
Cotton Mills, Compresses and Warehouses



**B. & O. R. R. Power House Equipped with Edwards Rolling Door**

The benefit of forty-four years' experience is placed by our Engineering Department at your disposal. Ask for catalogs and drawings.

# THE WARNER-QUINLAN ASPHALT COMPANY

79 WALL ST., NEW YORK

Manufacturers of the Montezuma Asphalts for Pavements, Waterproofing,  
Roofing, Paints, Etc.

---

## MONTEZUMA ELASTIC COATING

For Roofs and Steel Work

### AS A ROOFING

On new roofs of any kind.

On old tin roofs.

On old tar and gravel roofs.

On concrete roofs.

On any surface and any angle roof.

No paper or felt needed.

Makes a perfect elastic and waterproof covering.

Does not run or crack.

Lasts longer than any other material now in the market used for roofing.

### FOR STEEL COATING

On steel decks of vessels.

On interior of steel vessels.

On tanks.

On bridges.

On any steel structure.

It is applied hot.

No painting will be necessary and no rusting can take place where it is used.

# THE HASTINGS PAVEMENT CO.

EXECUTIVE OFFICES: 25 BROAD STREET, NEW YORK

PLANT: HASTINGS-ON-HUDSON, N. Y.

Manufacturers of Compressed Asphalt Paving Blocks and Tiles

## ASPHALT PAVING BLOCKS

The logical material for the wearing surface of streets and roads, and of piers, warehouses, loading platforms, bridges, factory floors, driveways, courtyards, etc. Manufactured at a permanent plant; shipped in block form ready to lay; and always obtainable in any quantity for extension or repairs.

**Composition and Size.**—A properly proportioned mixture of natural asphalt, crushed trap rock and limestone dust is heated to 300 degrees Fahr., and shaped into uniform blocks under a pressure of 6000 pounds per square inch. The blocks are 5 inches wide, 12 inches long, and 2, 2½ and 3 inches deep. Specific gravity, 2.40.

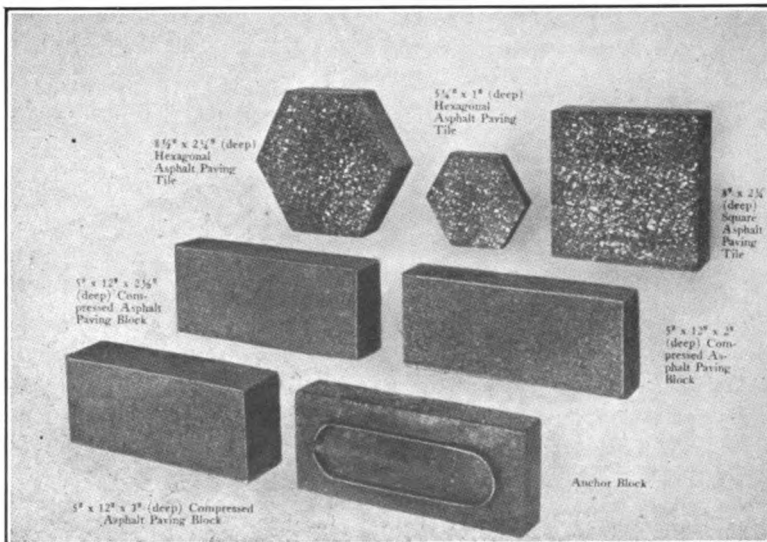
**Advantages.**—Asphalt block pavements are pleasing in appearance, smooth, noiseless, dustless, sanitary because non-absorbent, and next to granite the most durable. Present a gritty, non-slippery, non-skidable surface. Easily taken up and relaid. Reasonable cost. Not affected by extremes of temperatures. Made to suit any climate and traffic conditions.

**Method of Laying.**—Asphalt blocks are usually laid on a concrete foundation, upon which there is laid a bed of cement mortar one-half inch thick, which is struck to a true and even surface. Upon this bed the blocks are immediately laid with close joints and uniform top surface, the joints being broken four inches. After being laid, the blocks are given a light coat of sharp, fine sand, well broomed into the joints. Traffic is permitted in four or five days.

## ASPHALT TILES

A wearing surface especially designed for floors, sidewalks, and other surfaces subject to foot traffic. In the tiles, a selected white limestone is used for the mineral aggregate, instead of crushed trap rock, as used in the blocks. The particles of crushed limestone give to the tiles an exceedingly attractive appearance. They are of great density, free from voids, non-absorbent, and extremely durable, as tile laid over twenty years ago are still in service, showing but little wear.

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*Asphalt Block Floors*

*The Modern Floor for Heavy Service*

# THE H. B. SMITH CO.

WESTFIELD, MASS.

NEW YORK: 10 E. 39th Street

BOSTON: 138 Washington Street, North

PHILADELPHIA: 17th and Arch Streets

Manufacturers of Boilers and Radiators for Steam and Water Heating

## MILLS WATER TUBE BOILERS

*A. S. M. E. Standard*



No. 44 Steam Boiler

### No. 24 Boiler

Nominal Width of Fire Pot 24 inches.

Commercial Rated capacity	{	Steam 900 ft.
		to 2025 ft.
		Water 1500 ft. to 3350 ft.

### No. 34 Boiler

Nominal Width of Fire Pot 34 inches.

Commercial Rated capacity	{	Steam 2000 ft.
		to 5200 ft.
		Water 3300 ft. to 8575 ft.

### No. 44 Boiler

Nominal Width of Fire Pot 44 inches.

Commercial Rated capacity	{	Steam 3600 ft.
		to 9000 ft.
		Water 5950 ft. to 14850 ft.

### No. 48 Boiler

Nominal Width of Fire Pot 48 inches.

Commercial Rated capacity	{	Steam 4800 ft.
		to 12000 ft.
		Water 7925 ft. to 19800 ft.

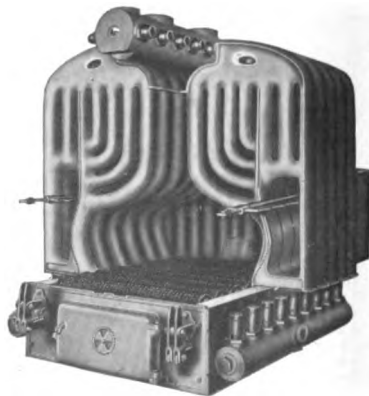
### Nos. 24, 34 and 44 Mills Boilers

Maximum allowable working pressure, steam 15 lb., water 50 lb. Tested at 125 lb. hydrostatic pressure.

### No. 48 Mills Boiler

Maximum allowable working pressure, steam 15 lb., water 80 lb. Tested at 200 lb. hydrostatic pressure.

Send for bulletin giving economic performance curves and other data concerning Mills Water Tube Boilers.



No. 44 Boiler—Interior



## THE H. B. SMITH CO.

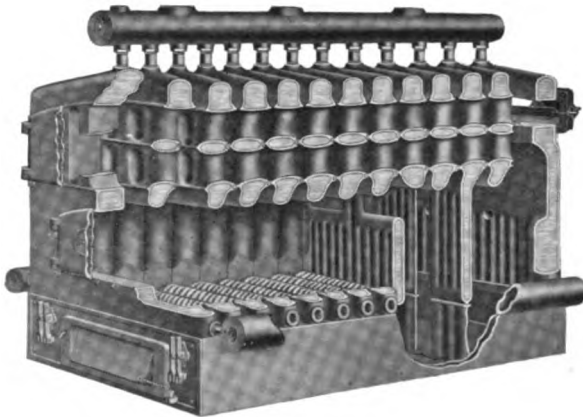
### SMITH BOILERS

*A. S. M. E. Standard*

with or without

**Smokeless Furnace for Bituminous Coals for Steam and Water Heating**  
(Pat. applied for)

Maximum Allowable Working Pressure—Steam 15 lb., Water 30 lb.  
Tested at 60 lb. Hydrostatic Pressure, A. S. M. E. Standard



**No. 36 Smith Boiler with Smokeless Furnace**

**DIRECT  
RADIATORS**

**Princess**

Test at Factory { Two tests 100 lbs. water.  
One test 80 lbs. steam.

Made in single, two, three and five column and wall radiators.

Send for complete Radiator Catalogue No. 101G.

### SMITH SERVICE BOILER W-17

**For Hot Water Supply**

*A. S. M. E. Standard.*

Tested at 500 lb. Hydrostatic Pressure.

Maximum Allowable Working Pressure 200 lb.

Performance data of these boilers will be sent upon request.





**CATALOGUE SECTION**  
**PART VI**

**Testing, Measuring and  
Recording Apparatus**

393

**Pages 394-424**

## TINIUS OLSEN TESTING MACHINE CO.

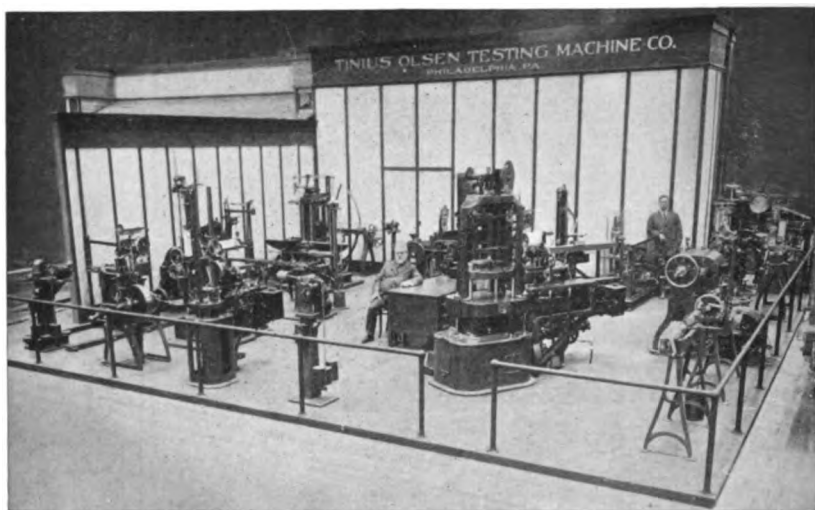
500 NORTH 12TH St., PHILADELPHIA, PA.

Manufacturers of Testing Machinery and Instruments

### OLSEN TESTING MACHINES

The following illustration is our exhibit of testing machinery at the Panama-Pacific International Exposition in San Francisco which covers the most complete up-to-date testing laboratory ever demonstrated.

This exhibit was awarded GRAND PRIX, the highest and only award of this kind ever made to a testing machine manufacturer.



In this exhibit are thirty different types of testing machines with the addition of a complete set of accessories and instruments. The exhibit is illustrated and described by our souvenir exposition pamphlet entitled "Olsen Testing Machines," which will be mailed on request.

We are the largest manufacturers of high grade testing machines in the world.

Builders of the largest testing machine in the world of 10,000,000 lbs. capacity used by the U. S. Bureau of Standards, at Arsenal Grounds, Pittsburgh, Penna.

Our Catalog covers all the latest up-to-date testing machines and is divided into eight parts as follows:

- Part A—Universal Testing Machines and Instruments.
- Part B—Spring Testing Apparatus and Machinery.
- Part C—Cement, Concrete and Road Materials Testing Machinery.
- Part D—Cloth, Yarn, Paper, Rubber and Leather Testing Machinery.
- Part E—Wire, Chain and Anchor Testing Machinery.
- Part F—Oil Testing Machinery and Dynamometers.
- Part G—Transverse and Beam Testing Machines. Foundry Testing Machines.
- Part H—Special Testing Machinery, Including Impact, Indentation, Vibratory, Bending, Hardness, Endurance, Torsion, Fatigue and Efficiency Testing Machines.

Any parts will be mailed on request.

Testing machines designed and built to meet any special requirements.

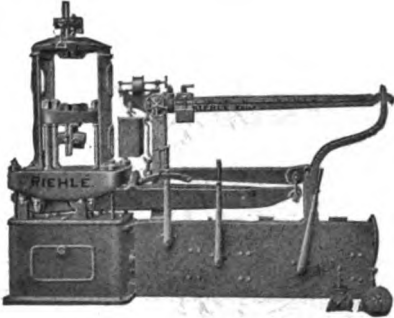
Our experts will be glad to recommend and lay out complete testing laboratories when desired.

# RIEHLÉ BROS. TESTING MACHINE CO.

1424 NORTH 9TH STREET, PHILADELPHIA, PA.

Manufacturers of Testing Machines and Testing Appliances

**RIEHLÉ TESTING MACHINES** are used by the leading Colleges, Steel and Iron Works, United States Government, many foreign Governments, and are recommended by many of the most prominent and successful Engineers throughout the world. We design and build these machines from **5000 lbs. to 2,000,000 lbs. and over** in capacity for the determination of any physical property.



**Riehle U. S. Standard Vertical Screw-Power Testing Machine. Three-Screw Type, 100,000 Lbs. Capacity**

## Features of Riehle Testing Machines

Designed Right.  
Plenty Strong Enough.  
No Sparing of Material.  
Long Base Lines.  
Simple in Construction.  
All Parts Accessible, without taking whole machine apart.  
Fine Finish. Attractive in Appearance.

## NOTE

We are now building all the Riehle Vertical Screw Power-Testing Machines with two (2), three (3), or four (4) Main Pulling Screws as may be desired.

For quick and convenient reference our complete line of Testing Machines is catalogued as enumerated below:

### **RIEHLÉ TESTING MACHINE CATALOGUE "A"**

Illustrating and describing all the large Riehle U. S. Standard Testing Machines, Screw and Hydraulic Power, also new and ingenious tools for same; Machines for Long Transverse Members, Torsional and Impact Testing, also Calibrating Levers.

### **RIEHLÉ CATALOGUE "AA" OF EXTENSOMETERS, COMPRESSOMETERS, AND TORSION METERS**

Containing illustrations and descriptions of the very latest and best Riehle Extensometers.

### **RIEHLÉ TESTING MACHINE CATALOGUE "B"**

Embracing all the various styles of Riehle U. S. Standard Testers for Wire, Cloth, Canvas, Cord, Twine and Textile Fabrics of all kinds, also for every variety of test. This Catalogue is well worth your careful perusal.

### **RIEHLÉ CHAIN TESTING MACHINE CATALOGUE "C"**

In this Catalogue is found all that is *newest and best* in Testing Machinery for Chain, Wire, Hemp, Rope, Eye-Bars, Bridge Irons, etc. Special Machines for different forms of materials can be designed along these lines. We also furnish Hydraulic Pumps separately if desired. We claim these Machines are the Strongest and Best in the World.

### **RIEHLÉ TESTING MACHINE CATALOGUE "D"**

Containing illustrations of Transverse Bending, and Special Testing Machines, Rope Twisters, Loam Mills, Pipe Provers, etc. Every Foundry and Machine Shop should install some of the articles shown in this Catalogue.

### **RIEHLÉ TESTING MACHINE CATALOGUE "E"**

Those interested in Machines for testing Springs of all kinds, also Oils and Bearing Metals, are specially referred to this Catalogue for all the newest and best Machines.

### **RIEHLÉ CATALOGUE "F"**

In this Catalogue are presented illustrations and descriptions of superior designs and patterns of Hand and Power Hydraulic Pumps and Presses, also Riehle-Robie Patented Screw Jacks, etc.

### **RIEHLÉ CEMENT-TESTING MACHINE CATALOGUE "G"**

In this Catalogue one will find "everything that is good" in the way of testing Cements, Asphalts, Building Material, and also every conceivable article for thoroughly equipping a Physical Testing Laboratory for that kind of work. Be sure and send for this Catalogue.

### **RIEHLÉ ROAD MATERIALS TESTING MACHINE CATALOGUE "K"**

In this Catalogue you will find illustrations of everything to make tests of Road Materials, as used by the United States Government, Department of Public Roads, Washington, D. C.

Select the Catalogues you want when ready to order.

*We are the oldest and largest Testing Machine manufacturers in the United States. Established nearly 50 years ago.*

## AMERICAN KRON SCALE CO.

430 E. 53RD ST., NEW YORK

Manufacturers of the Kron Automatic Springless Dial Scale



Showing Application of Kron Scale with Gravity Roller Conveyor

### THE KRON SCALE

Automatic—Springless

"LOAD AND LOOK"

*Portable and Dormant Types for Railroads, Factories, Warehouses, etc.*

The Kron Scale is an automatic weighing indicator for light and heavy work. All parts interchangeable regardless of capacity. Entirely free from springs. Equipped with air dash-pot. All metal construction. *It seals itself.*

Portable types made with platform size 24" X 24" and upward. Capacities, 200 lbs. and upward.

### Advantages of the Kron Scale

Where rapid and accurate weighing is desired the Kron Scale should be installed.

*The Kron is Automatic.* It is the only scale that will indicate the total load on the dial without any manipulation of extra weights or sliding poises.

*The Kron is Non-Vibrating*—the pointer always stops "dead" at accurate weight.

*The Kron is Highly Sensitive*—but it is not delicate and parts can be replaced within a very few minutes.

Industrial Railway Scale

Capacities up to 15 tons

Other capacities and types  
can be furnished

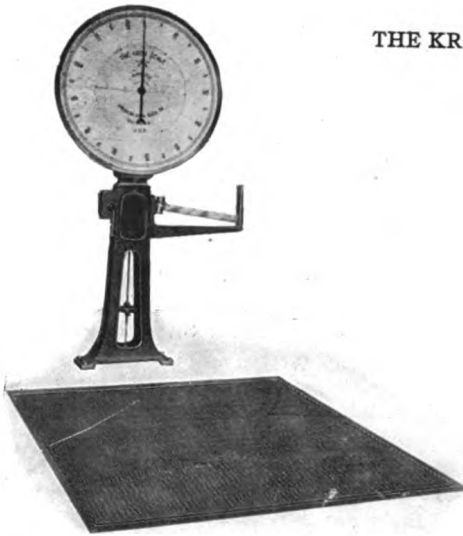


*The Kron is Strongly Built upon a Proven Principle—hence its maintenance cost is practically nil.*

# AMERICAN KRON SCALE CO.

## THE KRON SCALE (Continued)

### Dormant Type



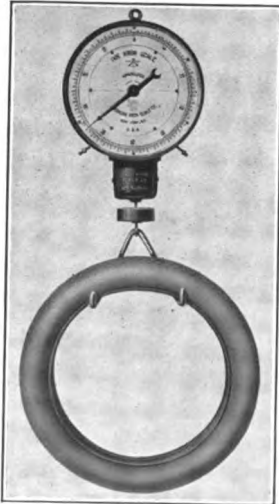
Equipped with Tare Beam and Locking Lever.

Suspension type platform, with Kron diamond checkered steel top.

All metal construction.

Capacity, 500 lbs. to 10,000 lbs.

Platform Dimensions, from 33" x 33" to 96" x 54".



### Hanging Type Kron Scales

Capacities, 30 lbs. to 10 tons



10,000 lb. Crane Scale in Service

# **AUTOMATIC WEIGHING MACHINE CO.**

134-140 COMMERCE STREET, NEWARK, N. J.

## **BRANCH OFFICES**

CHICAGO      PITTSBURGH      MEMPHIS      SAN FRANCISCO      HAVANA      LONDON

**Manufacturers of Automatic Machinery for Weighing, Packing, Sealing and Conveying Raw and Manufactured Products**

ADAPTED TO THE USE of manufacturers and packers of sugar, coffee, spice, washing powder, baking powder, starch, seeds, cereals, grains, flours, wheat, rolled oats, salt, fertilizers, cottonseed, cottonseed meal, powders, chemicals, tobacco, cement, clay, limestone, rock, clinker, gypsum, coal, etc.

**MACHINES FURNISHED SINGLY OR IN SETS FOR  
PROPORTIONING WORK**

### **"AUTOMATIC" SCALES**

Our scales are made in various sizes—some styles will weigh as low as one ounce; others up to a thousand pounds, according to the nature of the material to be handled, plant conditions, etc. They are fitted with feeds, special attachments, conveyors and the like. All guaranteed as to speed, accuracy and durability.

### **CARTON SEALING MACHINES**

These machines are simple in construction, and will turn out 35 perfectly sealed cartons per minute, with the use of only one operator. No air, steam or electrical lines used for sealing—machines are adjustable for different sized cartons.

*Get a copy of our Catalog covering the above more in detail,  
and with illustrations*



Remember that when specifying equipment, you want to give your client a guaranteed article, one that will **CONTINUE TO GIVE** satisfactory results. You cannot merely look at the selling price.—The most expensive in the end is usually the cheapest at the start.

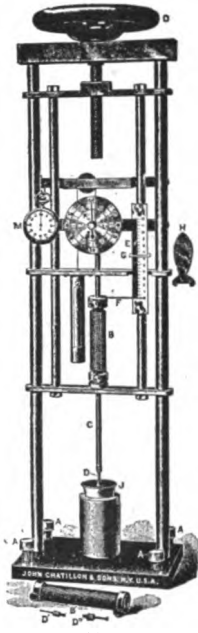
*We maintain an engineering department and will be glad to discuss any proposition with you, giving you the benefit of our years of experience.*



# JOHN CHATILLON & SONS

85-93 CLIFF ST., NEW YORK

Manufacturers of Consistometers, Dynamometers, Spring Balances, Scales, Etc.



The Abraham Consistometer

## THE ABRAHAM CONSISTOMETER

(Patent Applied for)

For Determining the Hardness or Consistency of Bituminous Materials.

All readings are expressed on a single scale of Hardness ranging from 0 to 100 points. The harder the substance, the greater its Hardness or Consistency—expressed numerically.

The range of the Consistometer is sufficiently great to include all commercial bituminous substances, from semi-liquids to hard brittle solids, also various bituminous compounds.

The Consistometer can be used for testing at any desired temperature, although 32 deg., 77 deg., and 115 deg. Fahrenheit are ordinarily adopted as standards.

Three plungers of special form are used.

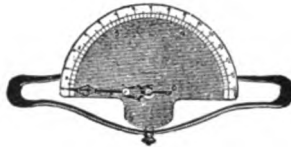
The method of testing consists in forcing one of the plungers into the substance at a uniform speed of one centimeter per minute.

The force is automatically registered in grams. The hardness or consistency of the substance is equal to the cube root of this number of grams. A table is supplied with each machine for converting the Consistometer readings to points or measure of hardness.

## DYNAMOMETERS

For Ascertaining the Draft of Ploughs, Wagons, Mowing Machines, Etc.

These Dynamometers may be had with one loose pointer to remain at maximum strain when used for testing purposes.



Dynamometer

500 lbs., 1000 lbs., 1500 lbs., and 2000 lbs. capacity by 25 lbs.  
2500 lbs., 3000 lbs., 3500 lbs., 4000 lbs. and 5000 lbs. capacity by 50 lbs.  
10,000 lbs., 15,000 lbs., 20,000 lbs., 25,000 lbs. capacity by 100 lbs.  
50,000 lbs. capacity by 250 lbs.

## HANGING SCALES

White Dial and Glass Sash

Full Capacity of Scale shown on Dial with one revolution of the Pointer.

Made with various sizes of Dials, also in various capacities.



Circular Spring Balances

## PLATFORM SCALES

For Counter Use

Size of Platform, 11½x14 inches. Distance from center of Dial to bottom of base 25 in.

The Dials on these scales have figures at every pound with every five pounds in red, the half-pound marks are heavy and far apart, making the Dial so plain that errors in reading are impossible.



Platform Scales

- No. 678, 50 lbs. by ½ lb., 10 inch Dial, Iron Platform  
No. 679, 50 lbs. by ½ lb., 10 inch Dial, Marble Platform  
No. 778, 50 lbs. by ½ lb., 13 inch Dial, Iron Platform  
No. 779, 50 lbs. by ½ lb., 13 inch Dial, Marble Platform  
No. 788, 100 lbs. by ½ lb., 13 inch Dial, Iron Platform

In addition to our regular line of Spring Scales, we make a great variety to order, for special purposes and of various capacities—some to register as fine as one-hundredth part of an ounce, and others as heavy as twenty thousand pounds. We can furnish scales for assorting, counting, multiplying, estimating, and also for various purposes of testing, etc.

All our Spring Scales are warranted to be accurate and perfect in workmanship.

# CHATILLON

TRADE MARK

# TOLEDO SCALE COMPANY

TOLEDO, OHIO

Branch Offices and Service  
Stations in All Large Cities

CANADIAN FACTORY  
WINDSOR, ONTARIO, CANADA

**Manufacturers of Springless, Automatic Scales for use in Factories, Warehouses, Mills, Foundries, and Shipping or Receiving Rooms of All Kinds**

Below are a few types of Toledo Automatic Scales adapted to different requirements. They are built on the famous gravity principle—correct in design and construction—accurate, efficient, reliable and durable—made as well as anyone knows how to make a scale.

No matter what your weighing problems may be, there is a Toledo that will solve them economically.



No. 821

No. 821. Toledo Automatic Portable platform scale. Equipped with locking device to protect automatic mechanism while scale is being moved. Capacities from 125 to 1,500 lbs.



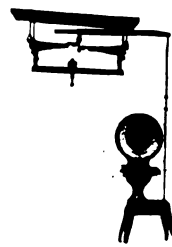
No. 921

No. 921. Dormant platform scale—all metal construction. Has wide variety of platform sizes, and capacities ranging from 500 to 3,800 lbs.



No. 1001

No. 1001. Toledo Hanging scale which can be equipped with hook, round pan or other means for sustaining load. Tell us your special requirements. Capacities from 50 to 150 lbs.



No. 1121

No. 1121. Toledo Overhead Track scale. Designed for rapid and efficient weighing. Capacities from 500 to 1,300 lbs.



No. 642

No. 642. Non-computing packing scale used largely by factories where accurate weighing is essential. Capacity 10, 15 or 20 lbs.



No. 581

No. 581. This scale automatically indicates the gross, tare and net weights of packages. For speedy packing, specially suited to factory use.

*Full information regarding Toledo Scales and their unusual time and money saving features will gladly be sent upon receipt of request.*

# JOHN SIMMONS CO.

110 CENTER ST., NEW YORK, U. S. A.

Steam and Mechanical Specialties

## LEINERT AUTOMATIC GRAVITY SCALES

### For Measuring by Actual Weight

WATER—OIL—SUGAR—JUICE—  
SPIRITS—PETROLEUM—AMMONIA—  
BRINE—CHEMICALS AND LIQUIDS  
OF ALL DESCRIPTIONS.

Simple: Accurate: Reliable

NOT AFFECTED BY TEMPERATURE  
PRACTICALLY NO WEARING PARTS

The Pre-eminent Meter for Power  
House Service.



**Types:** At the present time these machines are made in ten standard sizes with charge capacities (*i. e.*, contents of single bucket) from 10 lbs. in the smallest No. 1 machine, up to 2,000 lbs. The normal capacities per hour in the table are based on a conservative speed of one discharge (one tilt of the bucket) per minute.

The Type "A" machines have for inlet mechanism a three-way cylindrical valve and are suitable for all liquids with the exception of very sticky ones for which Type "C" machines having as inlet an oscillating trough, called deflector, should be preferred.

For measuring hot water or liquids emanating obnoxious gases the machines must be enclosed in a casing Type "AE" and Type "CE" machines.

The Type "B" machines in which the measuring buckets tilt under a reduced feeding stream make it possible to obtain, in a simple way, the highest degree of accuracy in the automatic weighing of liquids.

**Durability:** All parts being easily accessible can be cleaned whenever necessary even during operation. The measuring tanks and other parts in contact with liquid can be made of the best resisting material and are not otherwise subjected to serious wear.

**Accuracy:** These machines being a modified form of a one-lever balance with a single pair of knife edges, when once in operation, being free from human errors, obviously give in industrial practice an accuracy far superior to that obtained by hand weighing on commercial scales. Type "A" and Type "C" machines have an accuracy of less than one-half of 1 per cent., while Type "B" machines possess a correspondingly higher accuracy.

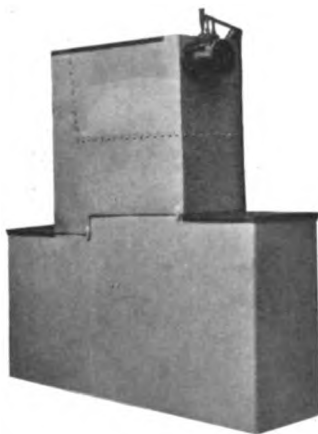
### LEINERT AUTOMATIC LIQUID SCALES TYPE "A"

SIZE NO.	APPROXIMATE NORM. CAPACITIES: Water, Petroleum, Milk, Etc.		LBS. PER DIS-CHARGE  CAPACITY OF TANK	SIZE OF INLET PIPE	APPROXIMATE DIMENSIONS			
	US Gals Per Min	Lbs. Per Hour			LENGTH	WIDTH	HEIGHT	BASE TO END SYPHON
1	1.1	600	10	$\frac{1}{2}$ "	1'-6"	1'-6"	1'-1"	0'-8"
3	7 $\frac{1}{2}$	3600	80	1"	2'-5 $\frac{1}{2}$ "	2'-5"	1'-9 $\frac{1}{4}$ "	0'-9"
4	12	6000	100	1 $\frac{1}{2}$ "	2'-10"	2'-9"	2'-3 $\frac{3}{4}$ "	0'-9 $\frac{1}{2}$ "
5	30	15000	250	2"	3'-9"	3'-8 $\frac{1}{2}$ "	2'-10 $\frac{1}{2}$ "	1'-3"
6	60	30000	500	2 $\frac{1}{2}$ "	4'-7"	4'-6"	3'-5"	1'-5"
8	120	60000	1000	3"	6'-0"	5'-8"	4'-0"	1'-8"
9	180	90000	1500	3 $\frac{1}{2}$ "	7'-0"	6'-7"	4'-7"	1'-9"
10	240	120000	2000	4 $\frac{1}{2}$ "	7'-9"	7'-4"	5'-2"	2'-4"

# WILLCOX ENGINEERING CO.

SAGINAW, MICHIGAN, U. S. A.

Manufacturers of Water Weighers



Willcox Rectangular Water Weigher with Storage Tank. Style C, Front View

## THE WILLCOX WATER WEIGHER

is a device for automatically weighing and recording the water fed to boilers. It takes water from any source, such as a feed-water heater, tank, pump or hydrant, at any rate of flow or at varying rates, and delivers it intermittently in charges of uniform weight.

It will weigh hot feed water from an open heater, cold water from a hydrant, water of condensation from vacuum pans or heating systems, also chemicals, caustic solutions, volatile oils, sugar juices, etc.

**Operation:** The charge is weighed by a liquid column of fixed height, through the medium of an air balance. The unit charge is dumped automatically by the sudden release of the entrapped air—an extremely accurate and reliable method of balancing.

**Accuracy:** Each weigher is guaranteed to weigh within one per cent of perfect accuracy at any rate of supply up to its maximum capacity.

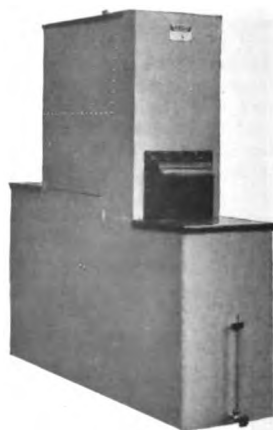
**Styles and Capacities:** The Willcox Water Weigher is built in several styles to suit various requirements: portable weigher for evaporative and condensing tests, and power-plant sets for permanent installation. All capacities from one thousand pounds per hour up to half a million pounds.

**Plans for Installation:** Suggestions, sketches and plans for proposed installations are furnished free of charge by the Willcox Engineering Company. We have competent engineers and draftsmen for the purpose of assisting prospective customers in planning suitable arrangements to meet local conditions.

**Savings Secured in Boiler Plants:** This simple, reliable, automatic self-recording device for continuously and accurately recording every pound of water pumped to the boilers, provides a means of segregating boiler evaporation cost from engine and generator performance, thereby determining from day to day whether or not proper evaporation is being secured per pound of coal.

## GENERAL DIMENSIONS—STYLE C RECTANGULAR, BUILT OF BOILER PLATE

Size No.	Maximum rate of weighing, in lbs. of water per hour	Size inlet, in.	Shell, thickness	APPROXIMATE	
				Ship'g weight	Weight of water per unit charge
5	200,000	6	1/4	2100	2700
7	150,000	6	1/4	1850	2250
9	100,000	6	3/16	1500	1800
11	75,000	4	3/16	1200	1500
12	62,500	4	3/16	1100	1180
14	40,000	3	9/64	600	680
16	25,000	2 1/2	9/64	400	420
18	15,000	2	9/64	275	200
20	10,000	2	9/64	175	120
22	5,000	1 1/2	9/64	150	60



The Willcox Automatic Water Weigher with Storage Tank. Style C, Rear View

Send for Water Weigher Catalogue W 9

# NATIONAL METER COMPANY

Established 1870

84-86 CHAMBERS ST.,

NEW YORK CITY

## BRANCH OFFICES

CHICAGO, 1227 Wabash Ave. BOSTON, 159 Franklin St. CINCINNATI, 224 East 4th St.  
PITTSBURGH, 4 Smithfield St. ATLANTA, 3d Nat. Bank Bldg. LOS ANGELES, 411 S. Main St.  
SAN FRANCISCO, 141 New Montgomery St. WINNIPEG, MANITOBA, 229 Spence St.  
LONDON, Caxton House

**Manufacturers of Water Meters and Gas Engines**

**THE CROWN METER** is a positive displacement water meter of the rotary piston type. This meter has been made and sold by us for nearly forty years. It is substantial, durable and accurate. We make this meter in sizes from  $\frac{3}{8}$ " to 6".

**THE EMPIRE METER** is a positive displacement water meter of the oscillating piston type. It is the most accurate, durable and generally satisfactory meter manufactured today. Owing to the simple construction of its measuring chamber the accuracy of this meter can be maintained indefinitely at a minimum cost. This meter is one of the best devices now manufactured for measuring oil. It is made in sizes from  $\frac{3}{8}$ " to 6".

**THE NASH METER** is a positive displacement water meter of the disc type. This meter has been on the market for over twenty-five years. The reinforced disc, frost-proof feature and straight reading register are a few of its many superior advantages. The meter is made in sizes from  $\frac{3}{8}$ " to 6".

**THE GEM METER** is a water meter of the velocity or current type and has been made by us since 1870. It is intended for service when a large and rapid delivery of water is of special advantage. It is made in sizes from 2" to 12".

**THE PREMIER METER** is a water meter constructed of a Venturi Tube and a by-pass on which an accurate, positive displacement meter is installed. This meter is intended to measure the complete supply of a city or other large service. The Premier is made in sizes from 8" to 48".

**THE EMPIRE COMPOUND METER** is a water meter constructed by combining our Empire and Gem meters. It will measure with great accuracy large and small flows, and will operate most satisfactorily under greatly varying conditions. The Empire section is always open. The Gem section is controlled by a check valve which opens automatically when called upon to measure a stream larger than the capacity of the Empire. This meter is made in sizes from 2" to 12".

*Our meters form a standard by which all others are judged.*

No matter what your conditions may be, we can offer you the

**BEST METER FOR YOUR SERVICE.**

# NEPTUNE METER COMPANY

50 EAST 42ND STREET, NEW YORK CITY

## BRANCH OFFICES

ATLANTA  
BOSTON  
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SAN FRANCISCO  
SEATTLE

SPOKANE  
VANCOUVER, B. C.  
LONDON, ENGLAND  
PARIS, FRANCE  
KOBE, JAPAN

Trident Water Meters—The Weber Subterranean Pump

Trident-  
Frost-  
Proof

Trident-  
Split-  
Case

Trident-  
Victor

Trident-  
Style 3



Trident-  
Crest

Trident-  
Compound

Trident-  
Protectus

Trident-  
Portable  
Test

## A TRIDENT FOR EVERY SERVICE

More than a million and a half Tridents in service give us pre-eminence among water-meter manufacturers, and speak for the *worth* of Trident Meters.

Our new catalogue is entitled "Twenty-Five Years of Success." It will be promptly sent upon request.

# BAILEY METER COMPANY

141 MILK ST., BOSTON, MASS.

Manufacturers of Recording Meters and Testing Instruments

## BAILEY FLUID METERS

Are the most practical and accurate meters for recording and integrating the flow of steam to turbines, engines, heating systems, general mill use; low pressure steam, exhaust, and in fact for all purposes. Equally well adapted to measure the flow of water, air, gases and other fluids, under practically all conditions of pressure, temperature and capacity.

There are but two moving parts to this meter and they are not subjected to the direct action of the steam, hot gases or other fluid being metered. The meter is operated by a pressure difference which is produced by the fluid flowing through an orifice placed between a pair of flanges in the pipe line.

Bailey Fluid Meter Type C2 Recording and Integrating Flow, also Recording Pressure and Temperature illustrated above.



## BAILEY BOILER METER

A radical departure from anything that has ever been developed.

Not only measures the steam output from the boiler, but also the air supply to the furnaces, showing whether it is the right amount, too much or too little for the best results. It shows, further, the condition of the fuel bed as to whether the fire is too thick or thin or may be provided with a flue gas temperature recorder and sensitive firebox draft indicator.

For any type of boiler, furnace or stoker. Helps the fireman get the best results from each boiler with respect to both efficiency and capacity.



Bailey Weir Meter

**BAILEY WEIR METER:** Recording and integrating flow of water or other liquids through V-Notch or rectangular weirs. For feed water, hot well discharge, etc., at or near atmospheric pressure. Illustrated at the left.

**BAILEY GAS FLOW METER:** Recording rate of flow of air or gas at low velocities and at or near atmospheric pressure. For measuring flue gas, mine ventilation, fan discharge, etc.

**BAILEY DIFFERENTIAL PRESSURE RECORDER:** Measuring pressure, suction or differential pressure of any gas or air. Extremely sensitive. Accurate to 1/1000" water. For draft in furnaces, flues, gas works, ventilating systems, mine ventilation, etc.

**"THE CO<sub>2</sub> METHOD OF STEAM MEASUREMENT."** Measuring steam flow with great accuracy regardless of pressure, temperature or density. For meter calibration and test work without any change in piping, weighing of water, or utilizing any pressure or temperature readings. Also adapted to water, air and gases.

*Bulletin No. 5 contains the complete line of Bailey recording meters and testing instruments. Sent free on request.*



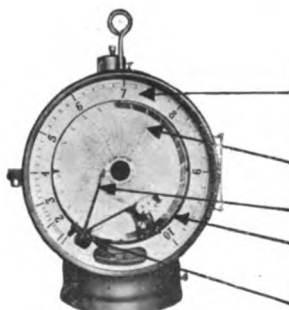
# GENERAL ELECTRIC COMPANY

GENERAL OFFICE: SCHENECTADY, N. Y.

Sales Offices in All Large Cities

## G-E FLOW METERS

For Measuring  
STEAM AND WATER



Indicating, Recording, Integrating  
Type FS-4 Steam  
Type FW-4 Water

{ Indicating Scale from  
which the Instantane-  
ous Rate of Flow is  
Read. }

{ Chart on which the  
Flow is Recorded. }

Curve Drawing Pen.

{ Integrating Dials from  
which the Total Flow  
is Read. }

Indicating Pointer.



Recording, Integrating  
Type F  
Steam or Water



Indicating, Recording  
Type FS-4 Steam  
Type FW-4 Water

{ Indicating Scale from  
which the Instantane-  
ous Rate of Flow is  
Read. }

{ Chart on which the  
Flow is Recorded. }

Indicating Pointer.

Curve Drawing Pen.



Recording  
Type F  
Steam or Water

Indicating, Recording  
Type FS-4 Steam  
Type FW-4 Water

{ Diameter of Scale is  
17 inches. }

{ Indicating  
Pointer }



Indicating  
Type FS-6 Steam  
Type FW-6 Water

{ Height of Figures on  
the Scale is  $\frac{7}{8}$  in. }

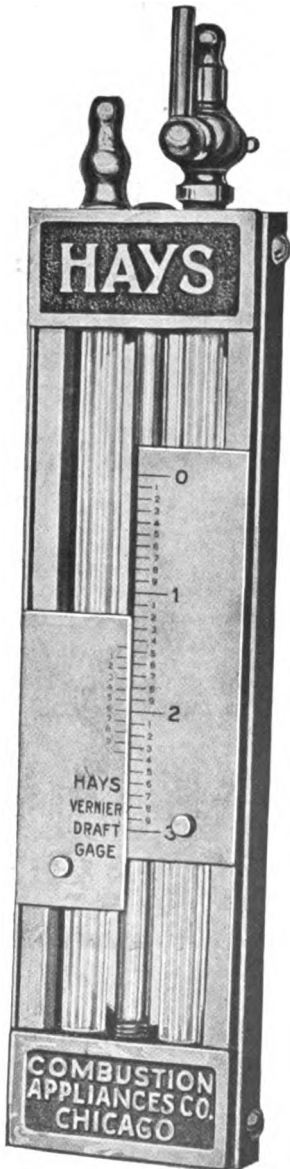
{ Indicating Scale from  
which the Instantaneous  
Rate of Flow is Read. }



## COMBUSTION APPLIANCES CO.

1778 ESTES AVE., CHICAGO, U. S. A.

Manufacturers of Hays Apparatus



### DRAFT GAGES

All varieties and ranges.

### Gas Analyzers

16 different models.

CO<sub>2</sub> and Draft Recorders.

Oxygen Recorders.

SO<sub>2</sub> Recorders.

Time Firing Indicators.

Coal Meters.

Indicating and Recording Pyrometers and Thermometers.

Steam Calorimeters.

Etc., Etc.

*Write and let us know your requirements.*

The illustration shows an indispensable pocket gage for the use of Consulting Engineers, erecting engineers, etc. Connect anywhere, set the vernier scales and read the vacuum or pressure to the hundredth of an inch of water.

# PRECISION INSTRUMENT COMPANY

DETROIT, MICHIGAN

Engineers

Manufacturers of Control Apparatus



**CO<sub>2</sub> Recorders**

For all percentages of CO<sub>2</sub>.  
Accurate to 0.5 of 1% CO<sub>2</sub>.  
24 hour and 60 day types.

**Our Products**  
CO<sub>2</sub> RECORDERS  
INDICATING GAUGES  
RECORDING GAUGES  
PICO GAUGES  
MICROMETER GAUGES  
DIFFERENTIAL GAUGES  
100 CC ORSATS  
50 CC ORSATS  
EFFICIENCY KITS  
BOILER TESTERS  
U GAUGES  
SPECIAL GLASS  
THERMOMETERS  
GAS COLLECTORS  
ARGAND BURNERS  
COAL CALORIMETERS  
CALORGRAPHS



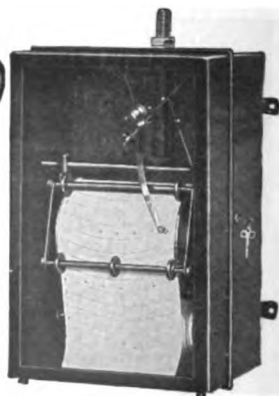
**"3 in 1" Gauge**  
The only combination gauge on the market. Designed for either forced draft or natural draft. Requires but little space on the Gauge Board.



**Recording Gauge**



**"PICO" Differential**



**60 Day Type**

Our recording gauges are of the Dead Beat and Pico types, for all ranges from 0-0.5 inch of water to highest ranges. They are guaranteed for accuracy, sensibility, and durability.

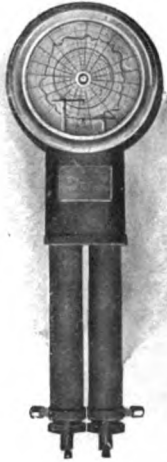
*Our catalogues will be sent you together with our A. B. C. of Combustion upon request.*



# UEHLING INSTRUMENT COMPANY

2011 EMPIRE BUILDING, NEW YORK CITY

Manufacturing Engineers—Combustion Economists



Record of CO<sub>2</sub> and Stack Temperature on One Chart

## UEHLING CO<sub>2</sub> RECORDERS

and other instruments as listed below

Uehling CO<sub>2</sub> Equipment provides the means for obtaining and maintaining high boiler efficiency. Such equipment consists of the **Instrument Proper**, which can be located in the engine-room or any other convenient part of the plant, the **Recording Gauge** which can be located in the office of the Chief Engineer or Superintendent, and the **Auxiliary CO<sub>2</sub> Indicator** which can be located at the boiler front so that the firemen can be held responsible for the fuel wasted up the chimney, just the same as he is held responsible for an even steam pressure by means of the steam gauge.

The per cent of CO<sub>2</sub> in the products of combustion is a true index of the excess air used, therefore the lower the per cent of CO<sub>2</sub> the greater the volume of products of combustion per pound of fuel consumed, and since all gases leave the boiler at stack temperature the per cent of CO<sub>2</sub> in the products of combustion bears a direct relation to the sensible heat wasted up the chimney.

## OTHER UEHLING INSTRUMENTS

Uehling Draft Recording Gauge.

Uehling Differential Draft Recorder.

Uehling Draft Indicator.

Uehling Differential Draft Indicator.

Uehling Draft Analyzer.

Uehling Light Pressure and Vacuum Recorder.

Uehling Vacuum Recorder.

Uehling Combined Barometer and Vacuum Recorder.

Uehling Absolute Pressure Indicator.

Uehling Pneumatic Pyrometer.

Uehling Revolution Recorder.

The distinctive features of Uehling Recording Instruments are *Simplicity*, *Accuracy* and *Reliability*. They are based on the *hydrostatic principle*, by the application of which all springs, levers and joint movements are avoided.

In addition to these important advantages, the hydrostatic principle permits of making the scale open, between the limits where the readings are important, and narrow, where they are unimportant, or eliminating that part of the scale altogether which is of no use, thus utilizing the whole width of the chart for important readings.

Send for Catalogs and booklet "Combustion and the Cost of Power."



CO<sub>2</sub> Indicator for Boiler Front

## THE ASHTON VALVE COMPANY

161 FIRST ST., CAMBRIDGE, BOSTON, MASS.

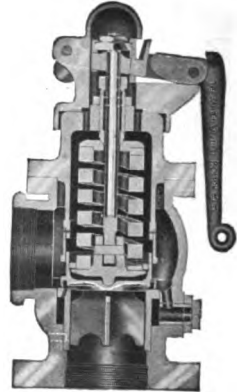
BRANCH OFFICES: 128 Liberty St., NEW YORK. 608 So. Dearborn St., CHICAGO, ILL.

**Manufacturers of Pop Safety Valves, Pressure and Vacuum Gages and Kindred Engineering Specialties**

### THE ASHTON IMPROVED POP SAFETY VALVE

embodies the latest improvements in the state of the Art and has been the acknowledged Quality Standard among Engineers for the past 46 years. When of proper size Ashton Valves give prompt and full relief to a boiler and prevent any accumulation of pressure above the point at which they are set. They are reliable and sensitive in action, and operate with a uniform and only moderate blow back, thereby showing greatest economy in both fuel and steam. They are solid in construction with all working parts of high grade material insuring most durable service and lowest cost of maintenance.

Ashton Pop Safety Valves are made to give any desired capacity of relief, and when so specified are furnished to fully comply with the requirements of the A. S. M. E. Boiler Code, as well as any special State or local regulations.



### THE ASHTON IMPROVED DEAD WEIGHT PRESSURE GAGE TESTER

offers the most modern method for obtaining an accurate test of pressure gages by means of weights. It is convenient in form and readily portable, being packed in two separate cases with locked covers and furnished with substantial handles.

The style illustrated with double area piston requires only one-fourth the usual number of weights and is suitable for high pressure testing up to a maximum of either 500 or 1000 lbs. per sq. in. It is also adaptable for low pressure testing by a simple adjustment of the two small valves on opposite sides of the vertical cylinder, which can readily be done while the machine is in use. Single Area Testers are furnished for pressures up to 300 lbs.



### THE ASHTON IMPROVED PRESSURE AND VACUUM GAGES

are made for all kinds of service in either plain registering or recording styles, and of either single or double spring construction. The springs are of best quality seamless drawn tubing, the movements non-corrosive with German Silver pinions and arbors, and the dials accurately graduated.

Ashton Recording Gages as illustrated give a daily record on paper charts showing all pressure variations both day and night giving the time and length of every change, thus assuring careful firing, steady pressure,

and highest efficiency and economy. Each gage is furnished with one year's supply of charts, ink and pen filler.



Our finely illustrated and descriptive book of 120 pages tells all about the full line of Ashton Specialties. Write for it NOW.

# **CROSBY STEAM GAGE & VALVE CO.**

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**Manufacturers of Standard Steam Appliances**

We present for the consideration of Mechanical Engineers certain instruments of our manufacture which we believe are scientifically and mechanically the best of their kind yet produced.

## **GAGES**

For any and all purposes.



**Crosby Pressure Gage**

## **RECORDING GAGES**

Daily, weekly or continuous records for Pressure, Vacuum, Hydraulic, etc.



**Crosby Pressure Gage Tester**

## **GAGE TESTING INSTRUMENT**

Made on scientific principles and is mathematically correct.

## **REVOLUTION COUNTERS**

Positive in action, reliable, durable.



**Crosby Revolution Counter**

## **RECORDING COUNTERS**

An instrument of wide application and of the greatest usefulness to engineers.

## **INDICATORS**

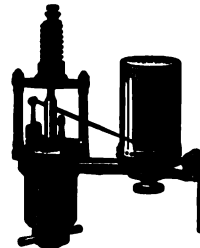
Steam, Gas, Hydraulic, etc.

As perfect in workmanship and operation as human skill can devise.

Also Lanza Continuous Diagram Appliance—Reducing Wheels—Boiler Test Pumps—Vacuum Pumps—Planimeters—Electrically Operated Chime Whistles—Valves for Steam, Ammonia, etc.

*All CROSBY Quality*

Address any of our stores and you will receive a prompt and courteous reply.



**Crosby New Indicator**

# J. E. LONERGAN CO.

211-215 RACE ST., PHILADELPHIA, PA.

Manufacturers of Boiler, Steam and Gas Engine Specialties

QUALITY  GAUGES



Pressure Gauge



Ammonia Gauge



Hydraulic Gauge

**Pressure Gauges** for steam, water or air, or vacuum. Pressure gauges graduated to any pressure not exceeding 500 lbs. Vacuum gauges graduated to 30".

Type "D" Short Spring, strong, non-freezable.

Model "GAS" Short Spring, strong, non-freezable, with Auxiliary Helical Spring attached to end of main spring, lengthening life of gauge where fluctuation of pressure or vibration is excessive.

Model "GDS" Double Spring, strong, non-freezable, made of one piece of seamless drawn bourdon tubing, insuring accuracy.

**Pressure and Vacuum Gauge:** Generally used on Compound Engines, Receivers, and Heating Systems.

**"Combination" Water Works Gauge:** Used to indicate pressure of water per square inch and corresponding height of column of water in feet. Adapted for use in Water Works, Pumping Stations, Mines, Stand Pipes, etc.

**"Altitude" Gauge:** Used to indicate height of water in feet in tanks, reservoirs and in connection with Hot-water House-heating Systems. Are generally graduated to 70 feet.

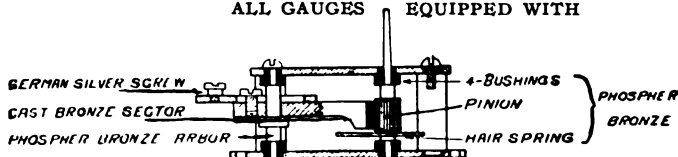
**Double and Auxiliary Spring "Locomotive" Gauges.**

**"Ammonia" Gauge:** Made expressly for use with ammonia and other liquids affecting brass. Tubes are made of a very high grade steel and carefully tempered. For use on ice and refrigerating machines.

**"Tractor Engine" Gauges:** Generally graduated to 300 lbs.

**"Hydraulic" Gauge:** Can be graduated to any pressure not exceeding 20,000 lbs. per square inch.

ALL GAUGES EQUIPPED WITH



Non-Corrosive Movement—Sectional View

Mechanical Men simply read our SPECIFICATIONS and are convinced.

"Movement" for all of our high-grade gauges.

All wearing bearings have PHOSPHOR BRONZE BUSHINGS twice their diameter in length. Sector, cast bronze, with face three times as wide as the regular sector.

Pinion, Arbor and Hair Spring, made of PHOSPHOR BRONZE.

This insures a gauge with exceptional wearing qualities, long life and accuracy.

"Springs" made for hard work.

Sector suspended vertically which reduces wear on teeth of sector and pinion to a minimum.

"Dials" all graduated by hand, made of brass, silver plated with black lettering.

# NATIONAL GAUGE AND EQUIPMENT COMPANY

GENERAL OFFICE AND PLANT

LACROSSE, WISCONSIN, U. S. A.

BRANCHES:

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NEW YORK

SAN FRANCISCO

Manufacturers of Steam Gauges, Vacuum Gauges, Altitude Gauges, Gasoline Tank Gauges, Air Pressure Gauges, Oil Pressure Gauges, Oxy-Welding Gauges, Automobile Equipment

## OXY-WELDING GAUGES



Fig. 212-0-2 Inch

The above cut shows our new style oxy-welding gauge in the two-inch size.

These gauges have received the hearty approval of all users of this equipment to whom they have been shown. They are made in sets or singly and when installed in sets make a neat, attractive and uniform appearance on tanks and regulators.

This gauge is a finished article in this line.

Send for catalog giving complete description and showing full line of gauges we manufacture.

# UNITED STATES GAUGE CO.

67 WALL ST., NEW YORK, N. Y.

WORKS: SELLERSVILLE, PA.

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**Manufacturers of Pressure Gauges Exclusively**



TRADE MARK

## OXY-ACETYLENE GAUGES

Graduated to indicate pressure and cubic feet in standard oxygen cylinders. Patented safety features comprise solid cast front and full back safety release.



U. S. Navy standard heavy bushed movement with  $\frac{1}{8}$ " face cast phosphor bronze segment and German silver pinion and arbors. Bearings deep bushed to give a bearing surface  $1\frac{1}{2}$  diameters long. Specially adapted for severe vibration service conditions.



## UNIVERSAL GAUGES

U. S. Standard Universal Dial Gauges, combining the American and metric standards, meet all export requirements.

**IF IT'S A GAUGE WE MAKE IT**



# THE BRISTOL COMPANY

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**Manufacturers of Bristol Recording Instruments for Pressure, Temperature, Electricity and Motion**



Recording Gauge

**BRISTOL'S RECORDING GAUGES** for steam, air, gas and liquids. For all ranges of pressure and vacuum.

**BRISTOL'S RECORDING LIQUID LEVEL GAUGES** for automatically recording depths or levels of water or other liquids.



Indicating Pyrometer

**BRISTOL'S RECORDING THERMOMETERS** for all commercial ranges of temperature from 60° below zero to 800° F.

**BRISTOL'S INDICATING ELECTRIC PYROMETERS** High Resistance Model, for measuring temperatures up to 3000° F.



Recording Pyrometer

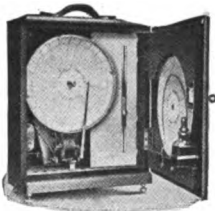
**BRISTOL'S RECORDING PYROMETERS**, High Resistance Model, for recording temperatures up to 3000° F.



Recording Thermometer

**BRISTOL'S RECORDING VOLTMETERS, AMMETERS AND WATTMETERS** for all ranges of A. C. and D. C. Can be furnished for switchboard or portable service.

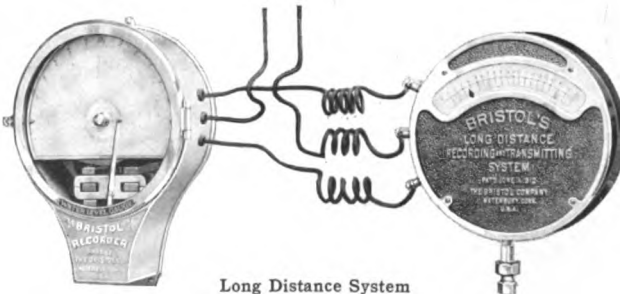
**BRISTOL'S ELECTRICAL AND MECHANICAL TIME RECORDERS** for recording time and mechanical movements, machine operation, valve reversals, etc.



Portable Voltmeter



Operation Recorder



Long Distance System

**BRISTOL'S PATENTED LONG DISTANCE ELECTRIC TRANSMITTING AND RECORDING SYSTEM** for measuring and recording at remote points, pressure, liquid level, temperature and motion. For instance, records may be transmitted over distances of five miles or more.

## THE BROWN INSTRUMENT CO.

PHILADELPHIA, PA.

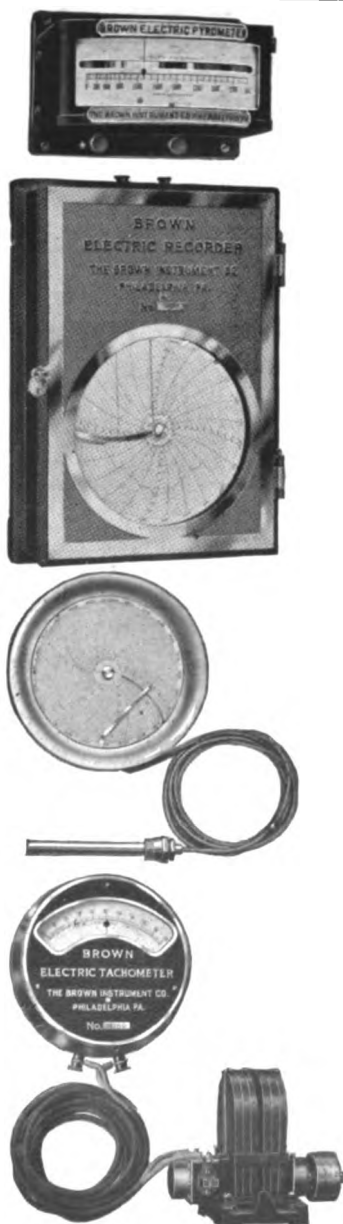
NEW YORK

PITTSBURGH

DETROIT

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**Manufacturers of Pyrometers, Thermometers, Tachometers, Time and Operation Recorders, Recording Gages, Voltmeters and Ammeters**



### Brown Pyrometers

Probably the most largely used Pyrometers in the world. Operates on the thermoelectric principal. Adapted for all ranges of temperatures from 300° F. to 3000° F. For temperatures below 300° F., Brown Resistance Thermometers are recommended. For temperatures above 3000° F., the Brown Radiation Pyrometer is extensively used.

### Brown Recording Pyrometers

Make a permanent record of temperatures—single or multiple charts as desired. Positive in action, sturdy in construction, accurate and with clear readings.

Brown Pyrometers are also made to regulate or control automatically the temperature of electric, gas, and oil furnaces.

### Brown Recording Thermometers

Operate on the well-known principle of the expansion of gas or liquid with change of temperature. The Capillary tube, which connects Bulb and Recording Gauge, can be as long as 100 ft. Fitted with flexible steel armored tubing. Sturdy in construction to withstand severe service.

### Brown Tachometers

Indicating and Recording types for measuring and counting revolutions per minute. The Electric type records machine operations hundreds of feet away. The Mercurial type operates by the unvarying law of centrifugal force.

### Other Scientific Instruments

Thermometers of the Mercurial type, pressure gages, recording gages, temperature controllers, time recorders, and vacuum gages are among other scientific instruments produced in our Laboratory, Wayne Junction, Philadelphia.

Anyone visiting Philadelphia will be most welcome to call and inspect the manufacture and design of the Brown line.

# THE SCHAEFFER & BUDENBERG MFG. CO.

BROOKLYN, NEW YORK

CHICAGO PHILADELPHIA WASHINGTON LOS ANGELES PITTSBURGH  
Instruments for Measuring, Indicating, and Recording Temperature, Pressure  
and Speed

## S & B GAUGES

A complete line of Pressure, Vacuum and Draft Gauges for all requirements, also Column Gauges, Mercury Pressure and Vacuum Gauges, Gauge Testers, etc.

### "CRESCENT" THERMOMETERS

Among our line of high grade "Crescent" Thermometers will be found an instrument for practically every purpose, and our catalog No. 200 illustrates over seventy types. Handsome in appearance and perfect in mechanical detail and construction.

Specify size of scale case desired, graduation, character and size of connection, character and length of stem, and the purpose for which the thermometer is to be used.



"Crescent"  
Thermometer

### "REFORM" THERMOMETERS



"Reform" Thermometer

A dial face, mercury-filled indicating thermometer having the accuracy of the standard glass tube thermometer and the conveniences of a dial face instrument. Entire working mechanism is made of steel, meaning long life. Standard size of dial 6 inches. Other sizes made to order. Furnished with either rigid connection or flexible capillary steel tube connection. The latter greatly facilitates installation. State the graduation desired, character and length of connection, and the purpose for which the thermometer is to be used.

### "COLUMBIA" RECORDING THERMOMETERS

The most simple, yet the most reliable type of Recording Thermometer. Mercury actuated, therefore, absolutely accurate. Steel construction throughout combining extreme strength and durability with accuracy. Uniformly graduated, wide and effective ranged charts with the popular day and night border, made in two sizes, 8" and 12", respectively, for 24 hours or 7 days. Furnished with either rigid connection or flexible steel protected steel capillary connecting tubing of any length. State size of chart and graduation, length and character of connection and the purpose for which the recorder is to be used.



"Columbia" Record-  
ing Thermometer

### THE "COLUMBIA" RECORDING GAUGE

An exceptionally accurate and reliable instrument adaptable for all ranges of pressure, vacuum and draft. In portable and stationary types, for 8" and 12" day and night charts, respectively, making one revolution in 24 hours or 7 days as desired.

State size of chart and graduations, and the purpose for which the Recorder is to be used.



The Columbia  
Recording Gauge

We have a most complete line of Hand and Stationary Tachometers and we have recently added many new styles and types, covering absolutely every requirement met with in practice. Constructed on the most modern principles, accuracy guaranteed, compact and durable in construction, perfect in mechanical detail and handsome in appearance.

State desired graduations and if Stationary Type Tachometer is wanted, the diameter and the normal speed of the shaft you will drive from.

### "COLUMBIA" TACHOMETERS

## CALORIMETERS



Calorimeter

We manufacture Professor Carpenter's pattern Calorimeters for Steam and Coal. The throttling type of Steam Calorimeter serves for determining the amount of moisture contained in steam. The Separating type is designed to show the percentage of water by mechanical separation of the water from the steam. The Coal Calorimeter is of great value in Power Plants as it determines the calorific power of coal almost directly in B. T. U.

S & B Calorimeters are easily operated, requiring no special technical knowledge, and results are most satisfactory for practical problems.



"Columbia"  
Tachometer



## C. J. TAGLIABUE MFG. CO.

18 to 88 THIRTY-THIRD STREET, BROOKLYN, N. Y.

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CLEVELAND  
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**Manufacturers of Instruments for Indicating, Recording and Controlling Temperature, Pressure and Liquid Levels**



Hohmann-type  
Thermometer

### MERCURIAL THERMOMETERS

Hohmann-type, as well as types of lower quality, in various sizes, forms and scale-ranges, for the requirements of

Stationary Power Plants  
Marine Power Plants  
Refrigeration Systems  
Water Cooling and Distillation  
Ventilating and Heating  
Industrial Plants, etc.

### AUTOMATIC CONTROLLERS

Of several types and various forms, according to requirements, for automatically maintaining—at exact point desired—either temperature, pressure or level when applied to

Condensers                      Forced and Induced Draft  
Feed Water Heaters           Systems  
Hot Water Service Tanks      Water Purification  
Stoker and Blower Systems   Condensing Systems  
Industrial Apparatus, etc.

### GAGES

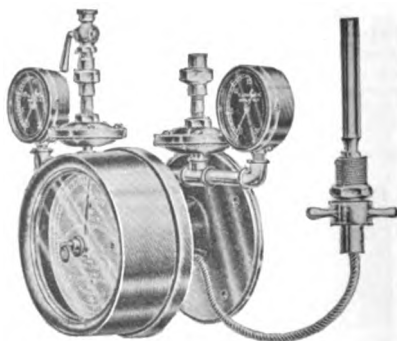
Mercurial, Water and Oil, of various types, for Vacuum and Pressure.

### OIL TESTING INSTRUMENTS

Hydrometers, Viscosimeters, Flash and Burning Point Testers, Freezers, Gage and Wantage Rods, etc.

### MISCELLANEOUS

Engineers' Testing Sets, Pyrometers, Barometers, Hygrometers, Hydrometers, etc.



"Perfect" type Automatic Temperature Controller

# TAYLOR INSTRUMENT COMPANIES

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**ST. LOUIS**  
Frisco Bldg., 908 Olive St.

**TORONTO**  
201 Royal Bank Bldg.

**Manufacturers of a Complete Line of Instruments for the Indicating, Recording and Regulating of Temperature and Pressure**

## TYCOS RECORDING THERMOMETERS

give continuous records of temperature. Made in both self-contained and flexible tube form for all industrial applications. Range—40° to 1000° Fahr.



Tycos Recording Thermometer



Tycos Temperature and Pressure Regulator

**H & M TYCOS AUTOMATIC TEMPERATURE AND PRESSURE REGULATORS** for processes requiring uniformity of temperature or pressure conditions. Type "A" illustrated above has a separable sleeve. Regulator can be removed from tank without drawing off contents.

## TYCOS PYROMETERS

Base Metal—0 to 2200° F.  
Rare Metal—0 to 3000° F.



Tycos Pyrometer

## FERY AND FOSTER RADIATION PYROMETERS

No upper limit of range.  
All forms furnished in single or multiple outfits, Indicating or Recording.  
All Tycos Recording Pyrometers furnish ink records on charts having Rectangular coördinates.

## TYCOS

### 'THERMO-TYME' TEMPERATURE REGULATOR

Automatically controls the length of time required to reach a fixed temperature as well as controlling the temperature after it has reached this maximum. Especially adapted to industrial applications requiring a gradual increase of temperature to a certain point and then control at this point without fluctuation.



Tycos Pyrometer Switchboard

If interested in Temperature Regulators, Pressure Regulators, Recording Thermometers, Angle and Straight Stem Thermometers, Engraved Stem Thermometers, Hydrotels and Hygrometers, Thermo-Electric and Radiation Pyrometers, our catalogues are indispensable—May we place them in your hands? Name type of instrument in which you are interested.



H & M Indicating Thermometer for Stack Temperatures

# WESTON ELECTRICAL INSTRUMENT COMPANY

49 WESTON AVE., WAVERLY PARK, NEWARK, N. J.

New York  
Buffalo  
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Johannesburg, South Africa

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London  
Paris  
Petrograd

Manufacturers of Instruments for Every Field of Electrical Measurement

## Weston

### ELECTRICAL INDICATING INSTRUMENTS

*An A. C. or D. C. Instrument for every purpose—laboratory, central station, or for any form of commercial electrical measurement or testing.*

The Weston A. C. Switchboard Instruments are unrivalled with respect to mechanical and electrical design and workmanship and hence with respect to performance.

Competent Engineers know that these Weston Instruments are the only types that perfectly meet the practical requirements of service, and they likewise know the initial cost is little if any more than the cost of inferior instruments, and that because of their continuous accuracy and serviceability these Weston Instruments are much more economical to adopt than instruments of any other make.



A. C. Switchboard  
Wattmeter, Model 167

Model 1 Portable D. C. Voltmeters are guaranteed to an accuracy of  $\frac{1}{6}$  of 1% (in terms of full scale length). They are dead-beat. The knife-edge pointer traveling over a mirror permits readings within  $\frac{1}{10}$  of a division at any part of the hand-calibrated scale.

In external appearance these Model 1 Instruments are very handsome. The metal case has an exceedingly durable royal copper finish. The base is of selected mahogany, highly polished.



Model 1

Weston A. C. Switchboard Instruments are fully described in Catalog 16. Model 1 and the various other D. C. Portable Instruments are described in Bulletin 501.

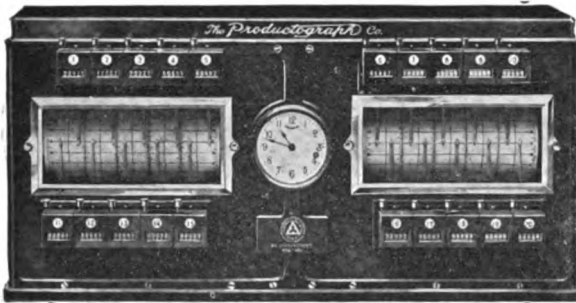
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Manufacturers of the Productograph



*The Productograph*

**"An Instrument  
for Recording  
Efficiency  
of Machines"**



TRADE MARK

The *Productograph* gives an absolute and correct record of lost time, productive working time, average speed and output, and it enables the Manager to put his hands on the weak links of his organization.

#### COMPONENT RECORDING FEATURES OF THE PRODUCTOGRAPH.

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- (2) Counter for reckoning total production.

The Productograph proper and its accessories have a special advantage in that each accessory forms a unit in itself. This arrangement makes it possible to supply the instrument fully equipped or with any combination of recording features in order to meet the requirements of any type of plant.

**Description:** The Productograph is designed to graphically record a complete history of the operations of machinery in a plant irrespective of what is being manufactured. Special switches are installed on the different machines throughout the plant and from these switches wires are brought to the Productograph located in the central office.

With this arrangement the operation of each machine is recorded, thereby providing accurate and immediate information covering the production and time loss of any machine in the plant.

The Productograph has been used in the following industries within the past three years: Molding, printing, lithographing, cloth finishing, cloth printing, rope making, brick making, box making, screw making, textile manufacturing, shrapnel, and motor car manufacturing.

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It is therefore essential that engineers familiarize themselves with this instrument, so that they may intelligently recommend its use whenever it can be advantageously used.

Irrespective of the nature of the requirements which may be desirable for any class of manufacturing plant, the Productograph is capable of executing the demands.

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## JAMES G. BIDDLE

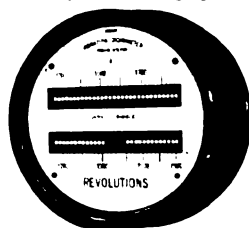
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Industrial and Scientific Instruments

### FRAHM VIBRATING-REED TACHOMETERS

The Frahm Tachometer is an instrument for measuring revolutions per minute, which is always "on the job," silently, continuously, accurately indicating speeds of the machine to which it is attached.

This remarkable achievement in tachometer construction results from a very simple application of the well-known principle of resonance. A classic illustration of this principle is to be found in two tuning-forks, each one of which develops the same number of vibrations. The prime-mover (or machine) to which a Frahm Tachometer is attached, corresponds to the first tuning-fork, and the instrument itself corresponds to the second one. Because it is practically impossible to perfectly balance any machine which contains rotating parts, each revolution produces a distinct impulse. For example, if a dynamo runs at 1000 R. P. M. there will be 1000 separate impulses per minute. Then if the Frahm Tachometer is calibrated properly, it will "respond"—just as the second tuning-fork does—and correctly indicate the speed. The practical application of this principle to industrial instruments, by Dr. Frahm, has required brilliant development work.



Frahm Tachometer with  
Two Rows of Reeds

#### *Special Characteristics of Frahm Vibrating-Reed Tachometers.*

**Rugged Construction:** There are no complex interior parts—such as delicate springs, jeweled bearings, pivots, pointer attachments, centrifugal weights, magnets and connecting wires. Practically nothing except a set of steel reeds, suitably mounted.

**Simplicity of Mounting:** No belt, gears, couplings or electrical connections are required—as it is only necessary to screw the Tachometer to a convenient part of the machine under test.

**Permanent Accuracy:** If accurate when installed—and that is merely a detail of manufacture—the instrument continues to be correct over long periods of constant duty; because the working parts do not change perceptibly with time.

**Small Up-Keep Cost:** Except in the case of an accident, a Frahm Tachometer will indicate speeds, year after year—twenty-four hours per day—without giving trouble of any kind. The instruments which come back to us for repairs, represent so small a proportion of the total number in use as to be quite negligible.

Frahm Tachometers are best suited for indicating speeds between 900 and 8000 R. P. M. For service outside these limits, a special actuating device must be used. After being thoroughly tried out under long-continued service conditions, these unique tachometers are being used by all builders of steam turbines. In many cases they are included as part of standard equipment—and in others are specified by purchasing engineers. Their field of greatest usefulness includes steam turbines, centrifugal pumps, centrifuges, turbo-blowers, dynamos, motors and all other machines that run at speeds between the limits above specified.

For full description and Price-List consult Catalog 855, free on request.

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**Jagabi Direct-Reading Hand Tachometers;** for speeds up to 4500 R. P. M.

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Also Megger Testing Sets and Bridge Meggers; Evershed Low Range Ducters; Siemens & Halske Precision Laboratory and Portable Voltmeters, Ammeters, Wattmeters, Shunts, Multipliers and Transformers; Hartmann & Braun High Frequency Ammeters and Wattmeters; "S-H" Standardizing Sets; Frahm Vibrating-Reed Frequency Meters; Wolff and Tinsley Potentiometers; Laboratory Rheostats.



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Manufacturers of Automatic Counters

**The Productimeter****MODEL A**

A strong, durable ratchet counter easily reset, adapted to stamping presses, conveyors and other severe uses. Also supplied with alarm bell for special applications.

Style	No. of Figures	Counting up to	Size Inches	Weight Pounds	PRICE, EACH	
					Plain	With Guard and Lock
4A-1	4	9999	7 x 2 1/4 x 1 3/4	3	\$ 8.50	\$10.50
5A-1	5	99999	8 1/2 x 2 1/4 x 1 3/4	3 1/2	10.00	12.00
6A-1	6	999999	10 x 2 1/2 x 1 3/4	4	12.00	14.00

**MODEL B**

A compact, full-g geared, dependable counter with outside reset. Brackets are arranged for securing to horizontal or vertical surfaces. Lever can be set at any position.



Type	Size Inches	Weight Pounds	PRICE	
			Five-fig.	Six-fig.
Standard with outside reset.....	3 3/4 x 2 3/8 x 2 1/4	2 1/2	\$10.00	\$12.00
Standard with outside reset and lock...	3 3/4 x 2 3/8 x 2 1/4	2 1/2	10.50	12.50
Rotary drive outside reset.....	3 3/4 x 2 3/8 x 2 1/4	2 1/2	10.00	12.00
Lineal measure attachment.....	.....	...	20.00	....



Type	Size Inches	Weight Pounds	Four-fig.	Five-fig.	Six-fig.
With outside reset.....	4 1/2 x 3 x 2	3 1/2	\$16.00	\$18.00	\$20.00
Nonresetting.....	4 1/2 x 3 x 2	3 1/2	12.00	14.00	16.00

**MODEL D**

A small compact counter with a sturdy, accurate driving mechanism, suitable for a wide variety of uses.



Type	Size Inches	Weight Ounces	PRICE	
			Four-fig.	Five-fig.
Standard with outside reset.....	2 x 1 1/4 x 1 1/4	8	\$8.00	\$ 9.00
Rotary drive with outside reset.....	2 3/4 x 2 x 1 1/4	14	9.60	10.80
Rotary drive nonresetting.....	.....	..	8.00	9.00

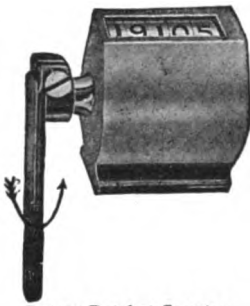
All prices subject to our regular discounts furnished upon request.

*The Productimeter is made in many different styles and sizes. If none of the models shown meet your requirements, write for catalog No. 10 describing our complete line.*

# THE VEEDER MANUFACTURING CO.

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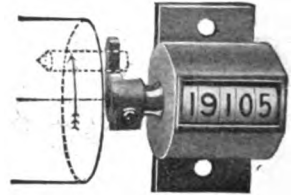
Makers of Cyclometers, Odometers, Tachometers, Tachodometers, Counters, Speed Counters and Fine Die Castings



Rotary Ratchet Counter



Hand Tally Counter

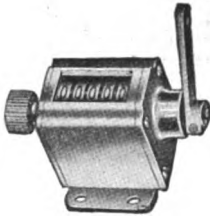


Revolution Counter

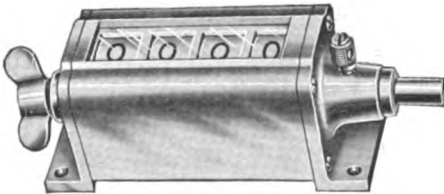
## VEEDER COUNTERS

Veeder products include a wide variety of counting devices for practically every purpose. The Set Back Counters illustrated here, are especially designed for use on all kinds of machinery where it is desired to keep accurate record of the amount of work done by the machine or operator. These instruments are so constructed as to operate with the greatest ease, thereby using practically no power. The quality of material and workmanship is so high that they will withstand long, arduous use. No one has ever questioned the instrumental excellence or the durability of Veeder Counters.

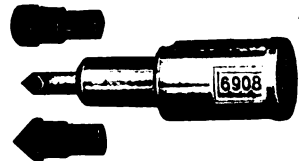
**Clutch Speed Counter**—For finding revolutions per minute made by a shaft or any revolving part. A stop watch is not needed because of the clutch in the counter. A ball thrust bearing is provided for the spindle. The straight reading index is easy to read and avoids errors.



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Set Back Counter



Clutch Speed Counter

We make counters for almost every conceivable purpose:

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For Automobiles and Horse-Drawn Vehicles, to Measure Distance Traveled.

### COUNTERS

To Register Revolutions or Reciprocating Movements. Twenty-five Styles.

### SPEED COUNTERS

For Finding the Revolutions per Minute Made by a Shaft or Any Other Revolving Part.

### TACHODOMETERS

To Indicate the Speed and Record the Distance Traveled, both Trip and Total.

For Use on Automobiles, Locomotives and Electric Railway Cars.

### TACHOMETERS

To Indicate Speed in Revolutions per Minute of Shafts, Generators, Motors, etc.

### FINE DIE CASTINGS

Where Large Numbers of Absolutely Uniform Small Parts Are Required.

Every mechanical engineer should have a copy of our complete catalogue, which describes more than 25 styles of counters. It will be supplied free upon receipt of application.



**DATA SECTION**  
**PART I**

**A. S. M. E. Standards**

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**Pages 427-457**



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## I OUTLINE OF PROCEDURE IN CREATING STANDARDS

Soon after its foundation in 1880, The American Society of Mechanical Engineers instituted the procedure of creating standards of method and dimensional standards and of issuing such standards in printed form for general use. To date upward of fifty such standards, or codes, have been formulated, and some of them have been widely adopted and have become the basis of extensive manufactures.

The consideration of a proposed standard by the Society has usually been inaugurated as the result of its attention being called to diversities of proportions existing in similar pieces produced by different manufacturers; variances in methods of measurement of similar quantities; lack of a uniform basis of expression of certain facts; absence of interchangeability, etc.

Sometimes the absence of the standard, and the consequent necessity of it, has been pointed out by a competent authority in a paper embodying a resolution recommending the expediency of the Society considering the matter and reporting. Sometimes an interested party has addressed the Society requesting an opinion, which has later been made the basis of a standard. Sometimes the Society itself has recognized the necessity for a uniform procedure and has taken the initial step toward its creation.

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In all cases, upon affirmative action by the Council of the Society, accepting the duty to formulate the standard, a committee of competent persons, members of the Society and other authorities, has been appointed to frame recommendations. Such committees have always been charged to take into their confidence all interested parties and to submit their findings to such parties for inspection and criticism before reporting them to the Society.

Reports of standards committees are presented at a general meeting of the Society and are, upon presentation, open for discussion by the whole membership and by others interested. Following such discussion, if, by vote, the recommendations still stand, the report is referred to the Council, who receive it and, upon approval by them, order it entered upon the record and printed in the *TRANSACTIONS* of the Society.

In cases where the field of action covered by a committee is very wide, viz., such as that of the Boiler Code Committee or the Power Test Committee, it has become the practice, on the acceptance of the committee's report and its subsequent discharge, to appoint a permanent committee to interpret the rules when called upon to do so, to make such revisions as may be found desirable, and to modify the rules to meet such new conditions as arise. These in-

terpretations and rules are formally approved at meetings of the permanent committee, and by letter ballot submitted to the members who could not attend the meeting. They are thereupon submitted to the Council, and if approved printed in *THE JOURNAL*. The permanent committee holds meetings from time to time at which all interested parties are given an opportunity to present suggestions with regard to the standards under consideration. These meetings constitute "revision periods" and take place at stated intervals, for instance, once in two or more years. All revisions of the codes or standards involving a change of meaning are reserved for these meetings, which may also take the character of "public hearings" so as to afford everybody interested an opportunity of stating his case in public.

Recent developments in the standardization work of the Society include the appointment, by amendment to the Constitution in the Spring of 1915, of the Standardization Committee as a standing committee of the Society. It is the function of this committee to standardize the method of making and arriving at standards rather than create standards themselves. This committee endeavors to bring about a unification of the standardizing work of the Society, and for this purpose national and international coöperation between organizations and governments, including an exchange of information with regard to standardization.

Finally there is the Standardization Committee of the National Engineering Societies to coöperate by representation on a proposed Joint Committee composed of three representatives each from the national engineering societies, to consider and report back to their respective societies suggested means of bringing about coöperation in the formulation of American Engineering Standards.

The Society is at all times prepared to formulate standards within its field of activity and to assist other organizations in the preparation of standards, and will, upon request, appoint members to serve on committees for this purpose. Several such coöperative committees are at work at the present time.

In introducing the following summary of the work of the standards committees and abstracts of standards reports, it should be reiterated that none of the reports are adopted by the Society. They are simply actions which carry weight and a recommendation but no further obligation. In practically all cases the standards have been accepted by outside parties, but of course without request by the Society. That they have been so widely incorporated bespeaks a recognition of the authority, ability and judgment exercised by the committees responsible for them.



## II REVIEW OF THE WORK OF STANDARDS COMMITTEES

In this review of the activities to date of the professional committees of the Society in recommending standards, the material is grouped under the following principal heads:

Testing Materials

Boiler Specifications

Power Tests

Electrical Standards

Flanges and Pipe Fittings, Screw Threads, Machine Screws

Gages, Measuring and Recording Standards

Safety Standards

Miscellaneous.

**Testing Materials.** In 1890 the Committee on Standard Tests and Methods of Testing Materials presented its first report on methods of conducting standard or scientific tests, in contradistinction to routine or shop tests. It also issued the results of certain international conferences on testing materials with recommendations as to their adoption and incorporation in American practice (Paper 380). The year previous, the committee's first official paper had been printed, being Appendix II to the 1890 report and comprising resolutions of international conferences on testing materials (Paper 378).

In Papers 479 and 480 the committee recorded the proceedings of the third International Conference for the unification of standard methods of testing materials of construction held at Berlin in 1890. In Paper 550, of 1893, it urged the inauguration of international conferences for the unification of methods of testing, and also urged that the United States Government take cognizance of such conferences by the sending of duly accredited representatives.

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In Paper 551, of 1893, were given the resolutions adopted by conferences at Munich, Dresden, Berlin, and Vienna, relative to uniform methods of procedure in testing building and structural materials. This paper supersedes Paper 378.

In Paper 654, of 1895, the committee took up the subject of standardization of castings and recorded the results of an investigation to show the relation between different sizes of castings poured from iron of a uniform composition; the chemical composition of each size of casting when cold, and also its physical properties.

In Paper 698, of 1896, were given the proceedings of the International Conference for the unification of methods of testing building and structural materials held at Zurich in 1895.

As a result of the formation of the American Society for Testing Materials, and its natural assumption of much of the work which this committee was doing and had planned to do, the latter did not present a final report, but the Society accepted each section and in 1900 discharged the committee.

The work has subsequently been carried on by the American Society for Testing Materials and by international congresses held from time to time, the first at Zurich in 1895, the second at Stockholm in 1897, the third at Budapest in 1901, the fourth at Brussels in 1906, the fifth at Copenhagen in 1909, and

the sixth at New York in 1912; the seventh, which was to have been held at Petrograd in 1915, has been indefinitely postponed.

**Boiler Specifications.** In the matter of boiler specifications, the first report was that of the Committee on Specifications for Boiler Plate, Rivet Steel, Steel Castings and Steel Forgings, which was made in 1903. (Papers 979 and 1026.) This report was only tentative, however, because of the formation at that time of the American Society for Testing Materials, which relieved the Society of much work on standardization of materials.

In September 1911 the Boiler Code Committee was appointed to formulate standard specifications for the construction of steam boilers and other pressure vessels and for their care in service. This committee completed a preliminary report in 1913, which was sent out to boiler manufacturers for inspection and criticism before the presentation of final recommendations to the Society. Subsequently, a draft report was printed and again subjected to severe criticism, in addition to a large amount of personal work being put into it by the individual members of the committee. Over forty organizations in all parts of the United States cooperated in this work by giving helpful suggestions or criticism.

The Boiler Code was discussed at Chicago in 1914, and again at the St. Paul-Minneapolis meeting in the same year. The discussion extended through six sessions of the Annual Meeting in New York in 1914, when the Boiler Code Committee presented its final report (Paper 1469).

The Boiler Code covers both new and existing installations, and deals with power boilers and heating boilers. Particulars are given in Paper 1469.

The Report recommended the appointment of a permanent committee to make such revisions of the rules as might be found desirable, and to modify them as the state of the art advanced, and that such committee should hold meetings at least once in two years, at which all interested parties might be heard. This recommendation was approved by the Council and the Committee accordingly appointed.

By Rules 331-4 of the Code, an official symbol or stamp (an enclosed "S") is to be used by the manufacturers to indicate that the Boiler Code Rules have been complied with in every detail in the construction of each boiler stamped with the symbol.

The American Uniform Boiler Code Congress assembled in Washington, D. C., December 1916, passed a resolution recommending that all states adopt it as standard, thus bringing standards, free interchangeability of boilers and efficiency together, to the end that manufacturers, users and inspectors might profit by the advantages of uniformity.

The first public hearing on the Boiler Code was held in December 1916 in the Engineering Societies Building and proved of unusual interest.

**Power Tests.** In 1884 a Committee on Standard Methods of Steam-Boiler Trials presented its report. This was discussed at Atlantic City in 1885 (Paper 168) and is known as the Code of 1885.

The object of a steam-boiler trial was taken to be the determination of the quantity of steam that a boiler can supply continuously and regularly under definitely prescribed conditions, the conditions and commercial value of the steam, the character of the combustion and the actual conditions of operation of the boiler when at work.

In 1899 a Committee on the Revision of the Code of 1885 for Conducting Steam-Boiler Trials presented its report, which is known as the Code of 1889 and shows a marked development over the original code of 1885, giving especial consideration to the fuel question and also endeavoring to overcome difficulties

encountered in the West with the first code. This code is printed in Paper 827, while Paper 828 gives the discussion on the report at the New York Meeting of 1899.

In 1890 the Committee on a Standard Method of Conducting Duty Trials of Pumping Engines presented a report to furnish a common basis on which to compare the economy of different engines, and proposed a new basis for economy of 1,000,000 B.t.u. in place of 100 lb. of coal (Paper 381).

In 1892 a Committee reported on standards for tests of engines and machinery at the Columbian World's Fair with a view to giving them a real scientific and comparable value (Paper 503).

In 1893 the Committee on a Standard Method of Conducting Locomotive Tests presented its report covering shop tests and road tests (Paper 552).

In 1902 a Committee appointed to standardize a system of testing steam engines presented its final report, known as the Code of 1902, which gives extensive rules covering the various phases of steam-engine tests (Paper 973). The discussion of this final report is given in Paper 974.

In 1904 the Society's Committee, coöperating as an advisory body with the Pennsylvania Railroad Company in conducting tests on locomotives at the Louisiana Purchase Exposition in St. Louis, presented its report (Paper 1109), and in 1914 the Sub-Committee on Railroads of the Committee on Meetings presented a report on steam locomotives of that day, summarizing the progress made since the Louisiana Purchase Exposition (Paper 1448).

In 1908 the matter of standardization of gas-engine tests was discussed, the discussion hinging mainly on gas-engine efficiency and heat value of gas, with arguments for the use of total-heat values and effective-heat values. A revised code for testing gas engines was submitted to the Council, with suggestions that the revision be placed in the hands of the Gas Power Section of the Society, now the Sub-Committee on Gas Power of the Committee on Meetings.

At the 1908 meeting a motion was carried providing for the revision of the report, then about three years old, on standard methods for conducting tests of gas engines. It was suggested that it would be desirable to revise the standards for testing of engines, placing all upon the heat-unit basis, the only proper basis for a duty test of an engine or for engine guarantee.

In 1909 the Committee on Revision and Extension of the Code for Testing Gas Power Machinery requested that their committee be discharged and suggested that a new committee be appointed to revise, unify and standardize all the present codes of the Society covering their various subjects. The Committee on Revision of the Standard Code on Steam-Boiler Tests also recommended that a revision be undertaken and a committee be appointed. It was voted that a committee of nine, to be named The Committee on Power Tests, be appointed to "revise the present testing codes of the Society relating to boilers, pumping engines, locomotives, steam engines in general, internal-combustion engines and apparatus and fuel therefor, and to extend these codes so as to apply to such power-generating apparatus as the present codes do not cover, including water power, and bring them into harmony with each other and with the best practice of the day." This committee was given power to resolve itself into as many sub-committees as might be required, the sub-committees to coöperate with and report to the whole committee. The final report of the Power Test Committee was presented at the Annual Meeting in 1915 and is printed in Paper 1526. Subsequently a permanent committee was appointed to interpret the rules and to make revisions from time to time, also to hold meetings at which

interested parties might have an opportunity to present suggestions, following the precedents of the Boiler Code Committee.

**Electrical Standards.** In 1897 the National Conference on Standard Electrical Rules presented its report, known as the National Electrical Code. This code (Paper No. 790) gives seventy-two rules divided into six classes. In 1903 the National Conference on Standard Electric Lighting Rules presented its report, proposing amendments to the National Electrical Code Rules (Paper 977).

In 1901 the Committee on Standardization of Engines and Dynamos proposed standards for direct-connected engines and generators (direct-current—Paper 887), and in 1901 the Committee presented a report embodying their final conclusions and recommendations (Paper 916). In 1905 the same committee presented an appendix to its report concerning the reduction of engine-shaft diameter beyond armature fit (Paper 1056).

In 1913 at the invitation of the American Institute of Electrical Engineers, a committee was appointed to cooperate with the Standards Committee and report concerning the use of the *myriawatt* as a unit. The report was presented at the Spring Meeting of that year.

In 1916 the Conference Committee on Electrical Engineering Standards considered the proposal to form a Joint Standards Committee with representation from all the national engineering societies, to act as a senate and give final approval to any standards proposed by the constituent societies.

The Conference Committee on Electric Power is cooperating with the Subcommittee on Cost of Electric Power of the Committee on Standards of the American Institute of Electrical Engineers.

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**Flanges.** The Committee on Flange Standardization reported its first standards in Papers 481 and 504, in which a table of proposed standards was submitted. Paper 826 gives the schedule of standard flanges adopted in 1899. The continually increased pressures to be resisted and the increasing diameter of pipe for large power stations, however, called for extensions of this standard.

In December 1901 the Committee on Standard Pipe Unions presented its report based on joint conferences with committees of other societies (Paper 917), and a supplementary report in 1902 (Paper 948).

In 1912 a special committee on flanges, cooperating with the National Association of Master Steam and Hot Water Fitters, formulated the 1912 schedule of standard weight and extra heavy flanges and flanged fittings, which has been adopted by the United States Government and by numerous organizations.

In 1913 the Committee on Standardization of Flanges presented recommendations as to a new standard to be known as the American Standard, to become effective January 1, 1914. This standard was arrived at after conferences with the Master Steam and Hot Water Fitters' Association and the Manufacturers' Committee, and is a compromise consistent with good engineering practice between the 1912 U. S. Standard heretofore recommended and that recommended in the same year by the manufacturers (Paper 1430).

During 1916 the Manufacturers' Standards Committee, representing companies manufacturing pipes and fittings, requested the cooperation of the Society's Committee on Standard Flanges and Pipe Fittings in the standardization of flanges for hydraulic work. Later this committee was asked to include flange fittings for ammonia apparatus and also steel fittings, and, by request of the American Railway Master Mechanics' Association, pipe unions. The title of the committee was changed to that of the Committee on Standards for Flanges and Pipe Fittings. The committee is investigating the strength of the various

sizes and weights of rolled-steel piping, thickness of pipe walls for cast-steel and semi-steel pipe and fittings, proportions for flanges, bolting and fittings for hydraulic pressures of 800, 1200 and 3000 lb. working pressure per square inch.

**Screw Threads.** A Committee on Standard Pipe and Pipe Threads formulated and recommended the Briggs standard, offered by the late Robert Briggs, of Philadelphia, a member of the Society. The report was presented in 1887; the standards are given in Papers 226 and 241.

A conference on the International Standardization of Pipe Threads was held in Paris, France, in 1908. The Society appointed a special committee whose report was forwarded for presentation at that conference. In 1913 the Committee on International Standards for Pipe Threads sent to the Paris representative instructions for presentation to the International Commission on Pipe Threads, which was initiated by the Société Technique de l'Industrie du Gaz in France. The American Gas Institute sent identical instructions to its representative.

The Committee on Standardization of Special Threads for Fixtures and Fittings presented its report in June 1915, giving standard dimensions for rolled threads for screw shells of electric sockets and lamp bases, and in December 1915 reported similarly for straight pipe threads (Papers 1474 and 1525).

In 1912 a committee was appointed to prescribe the permissible tolerances in the commercial manufacture of taps, bolts and screws, including their measurement. This committee is called the Committee on Tolerances in Screw Thread Fits. After outlining a general plan of procedure, including the securing of data on present practice, sub-committees were appointed to consider (a) present practice of satisfactory limits for commercial work; (b) requirements for higher-grade work where conditions are more exacting, and for lower-grade work of rough character; (c) methods of measuring taps, screws, nuts, etc.; (d) establishment of a nomenclature. The committee has already been in communication with the British Engineering Standards Committee, whose standards for limits and tolerances as first given required changes, which incidentally indicates the difficulty of the problem.

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**Machine Screws.** At the New York Meeting in December 1905 the Committee on Standard Proportions for Machine Screws presented its preliminary report, and at the Chattanooga Meeting in 1906 its completed report, with appended comment. This report was referred back for final revision.

At the New York Meeting in December 1906 a revised report was presented and discussions read, but on account of numerous requests it was referred back to the committee for another revision, and the final report was presented and accepted at the Indianapolis Meeting in May 1907. (See Papers 1142 and 1142-A.)

The report has been adopted by the Navy Department of the United States and embodied in the Department's specifications.

**Machine-Screw Nuts.** In 1917, at the request of the Navy Department of the United States, a joint committee of the Society and of the Society of Automotive Engineers was appointed to consider the question of the standardization of machine-screw nuts. This committee has held one meeting in Washington, but has as yet presented no report.

**Gages.** In 1882 a Committee on Standards and Gages reported on the Rogers-Bond Comparator (Paper 90).

In 1885 the Committee on a Standard Thickness Gage for Metals presented its report, recommending the use of the gage whose number for each thickness is the number of thousandths of a standard inch in that thickness (Paper 633).

In 1913 the Committee on Standardization of Pipe Thread Gages presented its report fixing manufacturing limits for the use of the Briggs Standard Pipe Thread Gages (Paper 1399).

**Measuring and Recording Standards.** In 1902 the Committee appointed to discuss the arguments in favor of and against the Metric System presented a report giving the points of general agreement and also stating the pro-metric and anti-metric sides of the case (Paper 972).

In 1905 a Committee presented a preliminary report on standard abbreviations, symbols, etc., in technical papers, giving fourteen rules with a list of examples (Paper 1054).

In 1905 the Committee appointed to suggest a standard tonnage basis for refrigeration presented its preliminary report, confining itself to a thermal rating and the establishment of a set of conditions representing good average engineering practice (Paper 1055).

In 1913 the Committee on Standardization of Catalogues presented its report recommending standard sizes for catalogues, folders, paper boxes, etc. (Paper 1394).

In 1914 the Committee on Standard Cross-Sections and Symbols presented its report (Paper 1468), and

In 1916 the Joint Committee on Standards for Graphic Presentation presented a preliminary report, which was published for the purpose of inviting suggestions.

**Safety Standards.** In 1915 the Sub-Committee on Machine Shop Practice of the Committee on Meetings presented a report, being a safety code for the use and care of abrasive wheels, covering protection flanges, protection hoods and protection chucks (Paper 1523).

In 1916 the Sub-Committee on the Protection of Industrial Workers of the Committee on Meetings presented a Code of Safety Standards for Electric Traveling Cranes, including rules for crane operators, floormen and repairmen (Paper 1572).

At the Spring Meeting in Cincinnati, May 1917, an Industrial Safety Session was held under the auspices of the Sub-Committee on Protection of Industrial Workers. Tentative drafts of two safety codes were presented and discussed. The first was a code of safety standards for industrial ladders, and the second referred to safety standards for power-transmission machinery. The latter was compiled under the direction of the Committee on Health and Safety of the National Association of Manufacturers. Both are reported in *THE JOURNAL*, July 1917, page 628 *et. seq.*

**Miscellaneous.** In 1884 a Committee reported on Natural Gas for Industrial Purposes, including its chemical composition, illuminating power and industrial uses (Paper 151).

In 1904 the Alloys Research Committee presented an appendix to its sixth report, being a summary of various papers on effect of strain and of annealing (Paper 1034).

In 1911 the Committee on Identification of Power House Piping presented a report recommending distinguishing colors to be used on valves, flanges and fittings of steam, gas, water and other pipe lines, etc. (Paper 1305).

In 1912 the Sub-Committee on Machine Shop Practice presented a report on the Development of Machine Shop Practice Through the Preceding Decade (Paper 1367).

In 1912 the Sub-Committee on Administration presented a report on the Present State of the Art of Industrial Management (Paper 1378).

The Sub-Committee on Fire Protection recommended a National Standard for Hose Couplings, which the Council ordered printed (Paper 1398). These standards are compromise standards which were agreed upon at a joint conference with a number of organizations interested.

In 1913 the Sub-Committee on Hoisting and Conveying presented a report reviewing developments and making preliminary recommendations (Paper 1403).

In 1914 the Committee on a Code of Ethics presented its recommendations regarding engineers' relations to clients, employers, etc. (Paper 1429).

In 1914 the Committee on Resolutions of the Snow Removal Conference held in Philadelphia, presented a report reviewing methods adopted in the principal cities (Paper 1450).

In 1909 a Committee on Standards for Involute Gears was appointed to formulate standards and report to the Council. It presented a majority report four years later.

The Committee on Recommended Practice for Standardization of Filters presented its report at the Annual Meeting, December 1916. It is printed in *THE JOURNAL* for February 1917, page 119.

### III ENUMERATION AND ABSTRACTS OF STANDARDS COMMITTEES' REPORTS

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In the following list are given, in the order of A. S. M. E. paper numbers, the reports of the various Standards Committees, with a short abstract of each paper. For more detailed information readers are referred to the volumes of *TRANSACTIONS* and *THE JOURNAL* of the Society, particulars of which are given with each abstract.

Reports on which no definite action has been taken as yet, and which do not, therefore, appear in this list, are mentioned under the heading Miscellaneous of the preceding summary.

Where reports have been superseded they are so marked.

Prices of reports to non-members are included in the cases of reports still in force; prices to members are one-half those specified.

#### Paper 90

#### REPORT OF COMMITTEE ON STANDARDS AND GAGES, ON THE ROGERS-BOND COMPARATOR

Presented and discussed at New York, November 1882. Printed in *Trans. Am. Soc. M. E.*, Vol. 4 (1883), pp. 21 to 29. (*Out of print*)

The comparator is used for comparing line measures of length with attested copies of the standard bars, subdividing these line measures and reducing them to end measures. The degree of accuracy attained is said to be such that no future improvements can occasion changes sufficiently great to affect the practical usefulness of the magnitudes determined or the interchangeability of structures based upon them with those involving further refinements.

**Paper 151****REPORT ON NATURAL GAS FOR INDUSTRIAL PURPOSES**

Presented and discussed at Pittsburgh, May 1884. Printed in Trans. Am. Soc. M. E., Vol. 5 (1884), pp. 340 to 375. 4 tables. (30 cents)

This report deals with the chemical composition of natural gas from Western Pennsylvania, its fuel value, illuminating power, and its uses in the industries; natural-gas piping practice, explosibility, pressure and temperature of gas from the well. It concludes with a discussion of the laws (34 P. L. 93) of Pennsylvania relating to water, gas, light and heat companies, and recommends further legislation. It also proposes measures to natural-gas consumers tending to security and economy.

**Paper 168****REPORT OF COMMITTEE ON A STANDARD METHOD OF STEAM-BOILER TRIALS**

Presented at New York, November 1884, and discussed at Atlantic City, May 1885. Printed in Trans. Am. Soc. M. E., Vol. 6 (1885), pp. 256 to 313. Discussion, pp. 314 to 351. 5 figs., 2 tables, 3 logs. (Superseded by Paper 827)

**(CODE OF 1885)**

The code proposed provides that the object of the test shall be precisely stated before the trial, and that an understanding be reached in regard to the kind of fuel to be used. During the trial the essential provisions are the preservation of the utmost possible uniformity of working conditions, the method of keeping the record of the test, and analyses of the escaping gases, when practicable.

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The committee recommends as the "unit of evaporation" "one pound of water at 212 deg. Fahr. evaporated into steam at the same temperature." For "commercial horsepower" it accepts the unit of "an evaporation of 30 lb. of water per hour from feedwater into steam at 70 lb. gage pressure. (This standard is equal to 33,305 thermal units per hour.)

**Paper 226****REPORT OF COMMITTEE ON STANDARD PIPE AND PIPE THREADS**

Presented and discussed at New York, November 1886. Printed in Trans. Am. Soc. M. E., Vol. 8 (1887), pp. 29 to 44. 1 fig., 2 tables. (10 cents)

The committee expresses the opinion that the Briggs Standard is the proper standard to be adhered to, and that it only requires definite coöperation on the part of pipe manufacturers with the committee, in order to bring their product strictly to that standard and to adopt means of strictly adhering to it within practical limits. An appendix gives complete data upon which the Briggs standard pipe-thread sizes are based, and a table of standard dimensions of wrought-iron welded tubes up to 10 in. in diameter.

**Paper 241****FINAL REPORT OF THE COMMITTEE ON STANDARD PIPE AND PIPE THREADS**

Presented at Washington, June 1887. Printed in Trans. Am. Soc. M. E., Vol. 8 (1887), pp. 347 to 350. (10 cents)

This report is on the consideration of a standard for pipe threads for purposes other than that which is covered by the Briggs formulæ and tables.



## Paper 378

## APPENDIX II TO REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF TESTING

Presented at New York, November 1889. Printed in Trans. Am. Soc. M. E., Vol. 11 (1890), pp. 527 to 572. 3 figs., 1 table. Index. (Superseded by Paper 551)

Resolution of the conferences held at Munich, September 1884, and Dresden, September 1886, relative to uniform methods of procedure in testing building and structural materials. (See Paper 380)

## Paper 380

## REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF TESTING MATERIALS

Presented and discussed at Cincinnati, May 1890. Printed in Trans. Am. Soc. M. E., Vol. 11, pp. 604 to 653. 6 figs., 19 tables. Index. Appendix. (*Out of print*)

Progress report on methods of conducting standard or scientific tests, in contradistinction to routine or shop tests, setting forth proposed recommendations under the following heads:

## I General Recommendations

- 1 Necessary conditions of testing machines
- 2 Holding appliances
- 3 Standard apparatus for routine testing
- 4 Standard drop-test apparatus
- 5 Determination of those qualities of material which suggest its adoption
- 6 Remarks on testing machine to accompany reports
- 7 Amplification of reports by stating source of test pieces, etc., etc.
- 8 Influence of time on tests

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## II Tests of Wrought Iron and Steel

- A Rails
- B Axles
- C Tires
- D Wrought iron for structural purposes
- E Low steels for structural purposes
- F High steels for structural purposes
- G Wrought iron for boilers
- H Low steels for boilers
- I Materials used in shipbuilding
- J Wire
- K Wire rope

## III Cast Iron

## IV Copper, Bronze, and Other Metals

## V Woods

## VIII Method of Testing

- 1 General recommendations for testing finished pieces in original shape
- 2 Tension test in general
- 3 Compression tests
- 4 Transverse tests
- 5 Torsion tests
- 6 Multiple or piece tests
- 7 Welding tests
- 8 Bending tests
- 9 Hardening tests
- 10 Forging tests
- 11 Punching tests
- 12 Abrasion test

## IX Shape of Test Pieces

- 1 For tension tests
- 2 For compression tests
- 3 For transverse tests
- 4 For torsion tests
- 5 For bending tests
- 6 Multiple or piece, welding, hardening, and abrasion tests.

The report also takes up the question of an international standard for testing materials, reviewing testing practice in France, Great Britain and Germany.

An addendum (see Paper 378) gives the general results and deliberations of a number of successful conferences held by German, Austrian, Swiss and Russian engineers to adopt standard methods, test pieces and machines. Their recommendations having been introduced universally, and, being in all essential particulars identical with custom in Great Britain and the United States, the committee considers it advisable to incorporate them.

## Paper 381

REPORT OF COMMITTEE ON A STANDARD METHOD OF CONDUCTING  
DUTY TRIALS OF PUMPING ENGINES (REVISED FORM)

Presented and discussed at Cincinnati, May 1890. Printed in Trans.  
Am. Soc. M. E., Vol. 11 (1890), pp. 654 to 687. 2 figs., 3 tables. Appendix.  
Discussion, Vol. 12 (1891), pp. 563 to 602. (Superseded by Paper 1526)

The main object of the standard proposed is to establish a mode of determining whether or not the guaranteed duty of a pumping engine is realized, and to furnish a common basis on which to compare the economy of different engines. The abolition of the unit of "100 lb. of coal" in favor of the new basis of "1,000,000 heat units" is proposed. Formulæ are recommended for computing duty and other quantities relating to performance.

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In order that a contract between builder and purchaser may conform to the proposed standard, a number of guarantees stated are recommended. The report describes the standard method of conducting duty trials, under the headings:

- 1 Test of Feedwater Temperatures
  - Directions for obtaining temperatures
  - Directions for measurement of feedwater
- 2 Main Duty Trial
  - Mode of procedure
  - Directions regarding arrangement and use of instruments
- 3 Leakage Test of Pump
- 4 Table of Data and Results
  - Duty trial of engine
  - Data and results of boiler test.

An appendix contains memoranda in regard to measurement of water by means of weirs, venturi tubes and nozzles.

## Paper 479

APPENDIX II TO REPORT OF COMMITTEE ON STANDARD TESTS AND  
METHODS OF TESTING MATERIALS

Presented for record at New York, November 1891. Printed in Trans.  
Am. Soc. M. E., Vol. 13 (1892), pp. 275 to 288. (10 cents)

Minutes of the third conference for the unification of standard methods of testing materials of construction, held at Berlin, September 1890. (See Paper 380)

**Paper 480**

**APPENDIX IV TO REPORT OF COMMITTEE ON STANDARD TESTS  
AND METHODS OF TESTING MATERIALS**

Presented for record at New York, December 1891. Printed in Trans.  
Am. Soc. M. E., Vol. 13, pp. 289 to 296. 2 figs. (10 cents)

Lecture by Prof. N. Bebelubsky, of St. Petersburg, on Comparison of Standard  
Shapes of Tension Pieces. (See Paper 380)

**Paper 481**

**REPORT OF THE COMMITTEE ON FLANGE STANDARDIZATION**

Presented at San Francisco, May 1892. Printed in Trans. Am. Soc. M. E.,  
Vol. 13 (1892), pp. 307 to 317. Appendix. (See Paper 504)

A progress report giving the forms of inquiry used by the committee to obtain  
the necessary information for compiling standards.

**Paper 503**

**REPORT OF COMMITTEE ON METHODS FOR PHYSICAL AND MECHAN-  
ICAL TESTS ON STEAM ENGINES AND MACHINES AT THE WORLD'S  
COLUMBIAN EXPOSITION, 1893**

Presented at New York, November 1892. Printed in Trans. Am. Soc.  
M. E., Vol. 14 (1893), pp. 41 to 47. (Out of print)

International expositions furnish an opportunity for careful tests of the relative  
merits of the various products, manufactures, machines and methods developed  
under different conditions in various parts of the world. This report enumerates  
the tests which it is desirable to undertake with reference principally to prime  
movers and natural products, materials and apparatus used in connection there-  
with.

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**Paper 504**

**REPORT OF THE COMMITTEE ON FLANGE STANDARDIZATION**

Presented at New York, November 1892. Printed in Trans. Am. Soc.  
M. E., Vol. 14 (1893), pp. 48 to 51. 1 fig., 1 table. (Superseded by Paper  
826)

The committee submits a table of proposed standards, tables of sizes in use by  
manufacturers, and a plotted diagram showing graphically the suggested scale  
of sizes. Scales for two pressures are proposed for sizes of 24 in. and over,  
one for pressures ranging up to 80 lb. and the other to 200 lb.

**Paper 550**

**REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF  
TESTING MATERIALS**

Presented at the Engineering Congress, Chicago, August 1893. Printed  
in Trans. Am. Soc. M. E., Vol. 14 (1893), pp. 1258 to 1261. (10 cents)

In this report the committee announces that it will present from time to time  
data and results from outside sources, the correctness of which has been developed  
and demonstrated at home or abroad.

## Paper 551

## APPENDIX V TO REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF TESTING MATERIALS

Presented at the Engineering Congress, Chicago, August 1893. Printed in Trans. Am. Soc. M. E., Vol. 14 (1893), pp. 1263 to 1311. 3 figs. Index. (Superseded by Paper 378.) (30 cents)

Resolutions of international conferences held at Munich, Dresden, Berlin and Vienna, relative to uniform methods of procedure in testing building and structural materials to determine their mechanical properties. This appendix supersedes Appendix II (Paper 378), in which a number of modifications must be made in order to make it agree with facts developed since the presentation of the appendix. The principal differences consist in rules for bending tests, tests of boiler plate, copper, and tiles, and finally the recommendations of a standard length of test piece developed from the proven relation of length and cross-section of test piece on results.

## Paper 552

## REPORT OF COMMITTEE ON A STANDARD METHOD OF CONDUCTING LOCOMOTIVE TESTS

Presented and discussed at the Engineering Congress, Chicago, August 1893. Printed in Trans. Am. Soc. M. E., Vol. 14 (1893), pp. 1312 to 1339. 8 figs., 2 tables. (Superseded by Paper 1526)

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The committee reports that for determining economy of boiler and engine, economy of compound and simple locomotives, and effect upon the economy produced by different classes of fuel and various methods of operation, the "shop test" is especially adapted; for determining other problems and to ascertain the performance of the engine in regular work, the "road test" should be used. In making road tests a dynamometer car should be employed, so as to obtain thereby the pull upon the drawbar. Tests should be conducted with such completeness that all the information relating to the performance of both the boiler and cylinders are determined.

As a standard basis for comparing efficiency, the number of pounds of standard coal burned per dynamometer horsepower per hour is recommended. The term "standard coal" refers to coal having a total heat of combustion of 12,500 B.t.u. per lb.

## Paper 633

## REPORT OF COMMITTEE ON STANDARD THICKNESS GAGE FOR METALS

Presented and discussed at Detroit, June 1895. Printed in Trans. Am. Soc. M. E., Vol. 16 (1895), p. 641. (30 cents)

The committee reports its success in bringing into acceptance the use of a gage whose number for each thickness is the number of thousandths of a standard inch in that thickness. Where a notched gage is used the suggested standard form is an oval gage, stamped with the words Decimal Gage.

## Paper 654

## REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF TESTING MATERIALS

Presented and discussed at Detroit, June 1895. Printed in Trans. Am. Soc. M. E., Vol. 16 (1895), pp. 1066 to 1081.

Results of an investigation showing the relation between different sizes of castings poured from iron of a uniform composition, the chemical composition of each size of casting when cold, and the physical properties of each. The tests were made in actual foundries.

The chemical composition represented all foundry mixtures from white iron to the softest gray; the physical properties determined were the grain, the shrinkage, the chill and the strength. Reports were made of the transverse, tensile and crushing strengths, and logs were included giving maximum fiber distance, moment of inertia, total stress, deflection, maximum stress on outer fiber, shearing stress, modulus of elasticity and resilience.

This report is supplemented by Paper 655, Transverse Strength of Cast Iron (review of results of above tests), by W. J. Keep; and Paper 656, Keep's Cooling Curves—A Study of Molecular Changes in Metals Due to Varying Temperatures, by the same author, and printed in the same volume.

## Paper 698

## APPENDIX TO REPORT NO. 380 OF COMMITTEE ON STANDARD METHODS OF TESTS AND TESTING MATERIALS

Published in Trans. Am. Soc. M. E., Vol. 17 (1896), pp. 748 to 757. (10 cents)

Proceedings of the Fifth International Conference for the unification of methods of testing building and structural materials, held at Zurich, September 1895.

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## Paper 790

## REPORT OF NATIONAL CONFERENCE ON STANDARD ELECTRICAL RULES

Presented at New York, November 1897. Printed in Trans. Am. Soc. M. E., Vol. 19 (1898), pp. 984 to 1021. 3 tables. Index. (30 cents)

(NATIONAL ELECTRICAL CODE)

Rules adopted by a National Conference on Standard Electrical Rules composed of representatives from sixteen bodies, including the Society. The rules are divided as follows:

Class A: Central stations, dynamo, motor and storage-battery rooms, transformer substations, etc.....	Rules 1-11
Class B: Outside work all systems and voltages.....	Rules 12-13
Class C: Inside work.....	Rules 14-39
Class D: Specifications for wires and fittings.....	Rules 40-55
Class E: Miscellaneous.....	Rules 56-59
Class F: Marine wiring.....	Rules 60-72

## Paper 826

## REPORT OF COMMITTEE ON FLANGE STANDARDIZATION

Presented at New York, December 1899. Printed in Trans. Am. Soc. M. E., Vol. 21 (1900), pp. 29 to 33. 1 fig., 1 table. (Supersedes Papers 481 and 504. Superseded by Paper 1430)

This report contains the schedule of standard flanges adopted by a committee of the Master Steam and Hot Water Fitters' Association, The American

Society of Mechanical Engineers, and the leading valve and fitting manufacturers of the United States. This schedule is called the August 1894 schedule, and differs from the schedule in Report No. 504 in the  $2\frac{1}{2}$ -in.,  $3\frac{1}{2}$ -in., 4-in., 9-in., and 12-in. sizes, the difference being in the flange diameters.

The report also contains a sample "Bates Flange Chart," prepared by Edward P. Bates, of the committee.

**Paper 827**

**REPORT OF COMMITTEE ON THE REVISION OF THE SOCIETY CODE  
OF 1885, RELATIVE TO A STANDARD METHOD OF CON-  
DUCTING STEAM-BOILER TRIALS**

Presented and discussed at New York, November 1899. Printed in  
Trans. Am. Soc. M. E., Vol. 21 (1900), pp. 34 to 111. 8 figs., 41 appendices.  
(Superseded by Paper 1526)

(CODE OF 1899)

When the Committee of 1885 formulated its code, the only coals in question were the anthracite of the Lehigh Valley and other coals of Eastern Pennsylvania, and the Cumberland coal as bituminous coal. Revision of the code is due largely to the fact that in its application in the Middle and Far West many difficulties were encountered and there was opposition to certain rulings. The revision is the result of the committee's effort to overcome this opposition. The amendments relate to the use of improved steam calorimeters, to sampling coal and determining its moisture, to calorific tests and analysis of coal, to analysis of flue gases, to smoke observations, to determinations of efficiency, and to methods of working out the heat balance.

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**Paper 828**

**DISCUSSION UPON THE PROVISIONAL AND AMENDED DRAFTS OF  
THE REPORT OF THE COMMITTEE ON THE REVISION OF THE  
CODE OF 1885, RELATIVE TO A STANDARD METHOD  
FOR CONDUCTING STEAM-BOILER TRIALS**

Presented at New York, December 1899. Printed in Trans. Am. Soc.  
M. E., Vol. 21 (1900), pp. 112 to 138. (20 cents)

This discussion relates to the previous paper, No. 827.

**Paper 887**

**REPORT OF COMMITTEE ON STANDARDIZATION OF ENGINES AND  
DYNAMOS**

Presented and discussed at Milwaukee, May 1901. Printed in Trans. Am.  
Soc. M. E., Vol. 22 (1901), pp. 520 to 530. 1 fig., 1 table. (Superseded by  
Paper 916)

The second report of this committee. The first report was a progress report, made at Cincinnati, May 1900, and printed in Trans. Am. Soc. M. E., Vol. 21 (1900), pp. 776 to 781, proposing standards for electric generators.

This report covers all the features of engines and dynamos to be standardized, with the exception of proportions of keys, and shrinkage allowance for armature fits. Its recommendations include:

## A. S. M. E. STANDARDS

- 1 Standard sizes of units
- 2 Corresponding r. p. m. for these units
- 3 Sizes of shaft for the two classes of center-crank and side-crank engines
- 4 Length along shaft required for generator
- 5 Height of axis of shaft over top of sub-base
- 6 Width of top of sub-base
- 7 Armature fit
- 8 Overload capacity of generators
- 9 Brush holders
- 10 Holding-down bolts, keys and outboard bearings.

### Paper 916

#### FINAL REPORT OF COMMITTEE ON STANDARDIZATION OF ENGINES AND DYNAMOS

Presented and discussed at New York, December 1901. Printed in Trans.  
Am. Soc. M. E., Vol. 23 (1902), pp. 99 to 110. 2 figs., 1 table. (See also  
Paper 1056.) (10 cents)

This report includes the features of Paper 887, together with recommendations of the points remaining to be standardized.

### Paper 917

#### REPORT OF THE COMMITTEE ON STANDARD PIPE UNIONS, PREPARED IN JOINT CONFERENCE WITH SIMILAR COMMITTEES OF THE AMERICAN RAILWAY MASTER MECHANICS' AS- SOCIATION AND THE MASTER CAR BUILDERS' ASSOCIATION

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Presented and discussed at New York, December 1901. Printed in Trans.  
Am. Soc. M. E., Vol. 23 (1902), pp. 111 to 124. 17 figs., 1 table. (See also  
Paper 948.) (10 cents)

The committee undertook the complete design of commercial sizes of malleable pipe unions for wrought-iron pipe from  $\frac{1}{2}$  in. to 4 in. inclusive. The mark "S" on the side of the nut was recommended as a designating mark, and this was copyrighted on the recommendation of the committee.

### Paper 948

#### SUPPLEMENTARY REPORT OF COMMITTEE ON STANDARD PIPE UNIONS

Presented and discussed at Boston, May 1902. Printed in Trans. Am.  
Soc. M. E., Vol. 23 (1902), pp. 681 to 685. 4 figs. (See also Paper 917.)  
(10 cents)

Following the publication of Report No. 917, some slight criticisms of certain parts of the designs were received. These criticisms are answered in this supplementary report.

### Paper 972

#### REPORT OF COMMITTEE APPOINTED TO DISCUSS THE ARGUMENTS IN FAVOR OF AND AGAINST THE METRIC SYSTEM

Presented and discussed at New York, December 1902. Printed in Trans.  
Am. Soc. M. E., Vol. 24 (1903), pp. 630 to 712. 21 appendices. (60 cents)

As a result of the report of the House Committee on Coinage, Weights and Measures, recommending the passage by Congress of the Metric-System Bill,

a committee was appointed to present a report. The committee agreed upon the following points:

- 1 Legislation designed to compel the exclusive use of the metric system is not desirable
- 2 Such legislation could not be enforced in any event so far as transactions between private individuals are concerned
- 3 The general government has the power to specify the system to be used in its own work and business, and can require that work done for it by contractors shall conform to any specified measurements or weights
- 4 The government cannot compel anyone to bid upon its specifications
- 5 Recognizing the well-settled fact that the consumer does and must pay all necessary costs of production, if the government specifies such dimensions as will materially increase costs of production, the government and not the bidder will have to pay such increased costs, it being self-evident that a bidder, not compelled to bid, will not bid except at a price which will afford him a profit
- 6 The bill now before Congress is intended to make the use of the metric system compulsory in the several departments of the government, but it cannot make it compulsory in private transactions
- 7 There is no force in that class of arguments which consists in taking integral dimensions in one system, translating them into equivalent and, therefore, fractional dimensions in the other system and then making comparisons. Such arguments can be made as strong for the one system as for the other.

In addition, members of the committee in favor of the metric system prepared a statement, and those against it prepared an answering argument, both of which are printed in the report.

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#### Paper 973

### FINAL REPORT OF COMMITTEE APPOINTED TO STANDARDIZE A SYSTEM OF TESTING STEAM ENGINES

Presented at New York, December 1902. Printed in Trans. Am. Soc. M. E., Vol. 24 (1903), pp. 713 to 790. 18 figs., 5 tables. (Superseded by Paper 1526)

(CODE OF 1902)

A proposed standard for testing in a scientific and practical way all the particular classes of engines, whatever the nature of their services, without conflicting with the recommendations of former committees of the Society relating to pumping-engine tests, locomotive tests and boiler tests.

The committee recommends that the standard of consumption should be referred to heat units, that indicated and brake horsepower be used as units of mechanical power, and that for the purpose of comparing economies the number of heat units consumed per hour, both per indicated and per brake horsepower, be used.

The committee gave due attention to a report of the Institution of Civil Engineers on the Definition of a Standard or Standards of Thermal Efficiency for Steam Engines.<sup>1</sup>

The committee chose as one of the important subsidiary forms of expressing efficiency that based on a so-called "standard coal" unit. The term "standard coal" refers to a coal which imparts to the steam 10,000 B.t.u. for each pound of dry coal consumed. (Calorific value, 12,500 B.t.u. per lb.)

<sup>1</sup> Proc. Inst. C. E., 1898, and as embodied in the British Standard Analysis Code.



## A. S. M. E. STANDARDS

The general recommendation in the report is, first, to satisfy the special object in view; that is, to lay down a form of test which shall serve as a standard for all steam engines, whatever their service, viz., the heat-unit test; second, to supplement the standard system thus framed with provisions for systematically determining other forms of expressing efficiency in steam engines; third, and as a further supplement, to standardize the methods of testing steam engines and results obtained with reference to their particular service, so far as this has not been heretofore accomplished; and fourth, to systematize the work of testing gas, oil and internal-combustion engines. The tables of data and results recommended are planned accordingly.

The rules for conducting steam-engine tests include:

- 1 Object of test
- 2 General condition of plant
- 3 Dimensions, etc.
- 4 Coal
- 5 Calibration of instruments
- 6 Leakages of steam, water, etc.
- 7 Duration of test
- 8 Starting and stopping a test
- 9 Measurement of heat units consumed by engine
- 10 Measurement of feedwater or steam consumption of engine, etc.
- 11 Measurement of steam used by auxiliaries
- 12 Coal measurement
- 13 Indicated horsepower
- 14 Testing indicator springs
- 15 Brake horsepower
- 16 Quality of steam
- 17 Speed
- 18 Recording the data
- 19 Uniformity of conditions
- 20 Analysis of indicator diagrams
- 21 Standards of economy and efficiency
- 22 Heat analysis
- 23 Temperature-entropy diagram
- 24 Ratio of economy of an engine to that of an ideal engine
- 25 Miscellaneous
- 26 Report of test.

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### Paper 974

#### DISCUSSION OF PRELIMINARY FORMS OF REPORT OF COMMITTEE ON STANDARDIZING ENGINE TESTS

Presented at Milwaukee, May 1901, New York, December 1901, and Boston, May 1902. Printed in Trans. Am. Soc. M. E., Vol. 24 (1903), pp. 791 to 846. (40 cents)

This includes the discussion of the first report of the committee at the New York Meeting, December 1902. In closing the discussion the committee states that the various criticisms and suggestions have been carefully weighed and that the report as it now stands embodies the final conclusions.

### Paper 977

#### REPORT ON MEETING OF NATIONAL CONFERENCE ON STANDARD ELECTRIC LIGHTING RULES

Presented at Saratoga, June 1903. Printed in Trans. Am. Soc. M. E., Vol. 24 (1903), pp. 885 to 888. (10 cents)

Amendments proposed by the A. S. M. E. delegate to the National Conference on Standard Electrical Rules, to the following National Electrical Code Rules:

**A. S. M. E. STANDARDS**

- No. 12 Constant-potential pole lines over 5000 volts
- No. 13 Grounding low-potential circuits
- No. 64 Signalling systems.

**Paper 978**

**REPORT OF SPECIAL COMMITTEE ON RULES AND METHODS**

Presented at Saratoga, June 1903. Printed in Trans. Am. Soc. M. E.,  
Vol. 24 (1903), pp. 891 to 920. (30 cents)

Second revised edition of the draft of the Constitution, By-Laws and Rules of the Society, with changes and amendments submitted by members and accepted by the committee previous to June 1, 1903.

**Paper 979**

**REPORT OF THE COMMITTEE ON SPECIFICATIONS FOR BOILER PLATE,  
RIVET STEEL, STEEL CASTINGS AND STEEL FORGINGS**

Presented and discussed at Saratoga, 1903. Printed in Trans. Am. Soc.  
M. E., Vol. 24 (1903), pp. 921 to 928. (Superseded by Paper 1469)

A tentative report based on the specifications prepared by the American Branch of Committee No. 1 of the International Association for Testing Materials. It was referred back for further action.

**Paper 1026**

**REPORT OF COMMITTEE ON SPECIFICATIONS FOR BOILER PLATE,  
RIVET STEEL, STEEL CASTINGS AND STEEL FORGINGS**

Presented and discussed at New York, December 1903. Printed in Trans.  
Am. Soc. M. E., Vol. 25 (1904), pp. 321 to 354. 1 table. (Superseded by  
Paper 1469)

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The American Society for Testing Materials was the outgrowth of the International Organization of which the A. S. M. E. was a member. Committee No. 1 of the American Society for Testing Materials prepared a series of specifications, and the present committee was appointed to consider them; and submitted a tentative report.

**Paper 1034**

**APPENDIX IV TO SIXTH REPORT OF ALLOYS RESEARCH COMMITTEE,  
BY DR. WILLIAM CAMPBELL**

Presented at Chicago, June 1904. Printed in Trans. Am. Soc. M. E.,  
Vol. 25 (1904), pp. 599 to 636. 109 photomicrographs. (30 cents)

This is a summary of various papers handed in by Sir William Roberts-Austen (October 1901), on the effects of strain and of annealing in aluminum, antimony, bismuth, cadmium, copper, lead, silver, tin and zinc.

**Paper 1054**

**PRELIMINARY REPORT OF A COMMITTEE TO COÖPERATE IN STAND-  
ARDIZING ABBREVIATIONS, SYMBOLS, PUNCTUATION, ETC.,  
IN TECHNICAL PAPERS**

Presented at New York, December 1904. Printed in Trans. Am. Soc.  
M. E., Vol. 26 (1905), pp. 60 to 63. (10 cents)

The committee consists of one member each of the American Society of Civil Engineers, The American Society of Mechanical Engineers, the American Institute of Mining Engineers and the American Institute of Electrical Engineers.

The report gives fourteen rules, with a list of examples, which are recommended to the four societies for adoption.

Paper 1055

PRELIMINARY REPORT OF COMMITTEE APPOINTED TO SUGGEST A  
STANDARD TONNAGE BASIS FOR REFRIGERATION

Presented at New York, December 1904. Printed in Trans. Am. Soc.  
M. E., Vol. 26 (1905), pp. 64 to 66. (10 cents)

The committee confined itself to a thermal rating and to the establishment of a set of conditions representing good average engineering practice. It considered the selection of units to measure the cooling effect or the refrigeration produced, and the selection of a standard set of conditions under which a refrigerating machine shall be run in determining its commercial tonnage capacity.

Paper 1056

APPENDIX TO REPORT OF COMMITTEE ON STANDARDIZATION OF  
ENGINES AND DYNAMOS

Presented at New York, December 1904. Printed in Trans. Am. Soc.  
M. E., Vol. 26 (1905), p. 67. (10 cents)

Recommends that "to facilitate pressing the armature upon the engine shaft, the engine builder should reduce the diameter of the shaft beyond the armature fit an amount not less than six thousandths of an inch."

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Paper 1109

REPORT OF COMMITTEE APPOINTED TO COÖPERATE WITH THE  
PENNSYLVANIA RAILROAD SYSTEM IN CONDUCTING TESTS  
OF LOCOMOTIVES AT THE LOUISIANA PURCHASE  
EXPOSITION

Presented and discussed at Chattanooga, May 1906. Printed in Trans.  
Am. Soc. M. E., Vol. 27 (1906), pp. 610 to 641, with appendix. 8 tables.  
(20 cents)

The appendix is a brief abstract from "Locomotive Tests and Exhibits, Pennsylvania Railroad System, Louisiana Purchase Exposition" published by the Pennsylvania Railroad, setting forth the results of the tests.

Paper 1142

REVISED REPORT OF COMMITTEE ON STANDARD PROPORTIONS FOR  
MACHINE SCREWS

Presented at Indianapolis, May 1907. Printed in Trans. Am. Soc. M. E.,  
Vol. 29 (1907), pp. 99 to 122. 1 insert, 14 tables. (20 cents)

The committee's first report was presented at New York, December 1905, and after discussion and amendments again at Chattanooga, and New York (1906). It was accepted at Indianapolis by a unanimous vote of the Society. The report also includes a statement as to the "Automobile Association Standard Bolts and Nuts."

## Paper 1142A

## CONDENSED TABULATION OF REPORT OF COMMITTEE ON STANDARD PROPORTIONS FOR MACHINE SCREWS

Presented at Indianapolis, May 1907. Printed in Trans. Am. Soc. M. E., Vol. 29 (1907), pp. 99 to 122. (10 cents)

This is issued on the authority of the committee and contains tables for standard and special screws, standard and special taps, heads and templet gages. One of these tables, here reproduced as Table 1, gives dimensions of standard screws. All dimensions in decimal parts of an inch.

TABLE 1 STANDARD SCREWS

Old No.	NEW	OUTSIDE DIAMETERS			PITCH DIAMETERS			ROOT DIAMETERS			THICKNESS OF TEMPLET GAGES
	Outside diam. and threads per inch	Minimum	Maximum	Difference	Minimum	Maximum	Difference	Minimum	Maximum	Difference	
0	.060-80	.0572	.060	.0028	.0505	.0519	.0014	.0410	.0438	.0028	.161
1	.073-72	.0700	.073	.0030	.0625	.0640	.0015	.0520	.0550	.0030	.166
2	.086-64	.0828	.086	.0032	.0743	.0759	.0016	.0624	.0657	.0033	.172
3	.099-56	.0955	.099	.0035	.0857	.0874	.0017	.0721	.0758	.0037	.180
4	.112-48	.1082	.112	.0038	.0966	.0985	.0019	.0807	.0849	.0042	.192
5	.125-44	.1210	.125	.0040	.1082	.1102	.0020	.0910	.0955	.0045	.199
6	.138-40	.1338	.138	.0042	.1197	.1218	.0021	.1007	.1055	.0048	.208
7	.151-36	.1466	.151	.0044	.1308	.1330	.0022	.1097	.1149	.0052	.218
8	.164-36	.1596	.164	.0044	.1438	.1460	.0022	.1227	.1279	.0052	.218
9	.177-32	.1723	.177	.0047	.1544	.1567	.0023	.1307	.1364	.0057	.231
10	.190-30	.1852	.190	.0048	.1660	.1684	.0024	.1407	.1467	.0060	.239
12	.216-28	.2111	.216	.0049	.1904	.1928	.0024	.1633	.1696	.0063	.249
14	.242-24	.2368	.242	.0052	.2123	.2149	.0026	.1808	.1879	.0071	.271
16	.268-22	.2626	.268	.0054	.2358	.2385	.0027	.2014	.2090	.0076	.285
18	.294-20	.2884	.294	.0056	.2587	.2615	.0028	.2208	.2290	.0082	.303
20	.320-20	.3144	.320	.0056	.2847	.2875	.0028	.2468	.2550	.0082	.303
22	.346-18	.3402	.346	.0058	.3070	.3099	.0029	.2649	.2738	.0089	.324
24	.372-16	.3660	.372	.0060	.3284	.3314	.0030	.2810	.2908	.0098	.350
26	.398-16	.3920	.398	.0060	.3544	.3574	.0030	.3070	.3168	.0098	.350
28	.424-14	.4178	.424	.0062	.3745	.3776	.0031	.3204	.3312	.0108	.384
30	.450-14	.4438	.450	.0062	.4005	.4036	.0031	.3464	.3572	.0108	.384

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## Paper 1305

## REPORT OF COMMITTEE ON IDENTIFICATION OF POWER-HOUSE PIPING

Printed in Trans. Am. Soc. M. E., Vol. 33 (1911), p. 17. (10 cents)

The committee recommends distinguishing colors for pipe lines, to be applied to valves, flanges and fittings only.

## Paper 1367

## REPORT OF SUB-COMMITTEE ON MACHINE SHOP PRACTICE ON DEVELOPMENTS IN MACHINE SHOP PRACTICE DURING THE LAST DECADE

Presented at New York, December 1912. Printed in Trans. Am. Soc. M. E., Vol. 34 (1912), pp. 847 to 865. (20 cents)

The principal improvements during the last ten years are reviewed under such headings as increased weight of machines, foundations, electric drive, automatic

machines, training mechanics scientific management, standardization of grinding tools, checking systems for small tools, drilling machines, lathes, milling machines, gear making, small tools, etc.

**Paper 1378**

**MAJORITY REPORT OF SUB-COMMITTEE ON ADMINISTRATION ON  
THE PRESENT STATE OF THE ART OF INDUSTRIAL MANAGEMENT**

Presented and discussed at New York, December 1912. Printed in Trans.  
Am. Soc. M. E., Vol. 34 (1912), pp. 1131 to 1229. 3 appendices and minority  
report. (70 cents)

The committee reviews the conditions leading up to the recent changes. It obtained information from recognized experts and submits a summary statement of this under such headings as labor-saving management, regulative principles of industrial management, the practice of management, statistical data, etc.

**Paper 1394**

**REPORT OF COMMITTEE ON STANDARDIZATION OF CATALOGUES ON  
STANDARD SIZES OF CATALOGUES**

Presented at Baltimore, 1913. Printed in Trans. Am. Soc. M. E., Vol. 35  
(1913), pp. 269 to 274. (10 cents)

The committee recommends standard sizes for index cards, folders, catalogues,  
paper boxes, filing boxes and cabinets.

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**Paper 1398**

**REPORT OF SUB-COMMITTEE ON FIRE PROTECTION ON STANDARD  
THREADS FOR HOSE COUPLINGS**

Presented at New York, December 1913. Printed in Trans. Am. Soc.  
M. E., Vol. 35 (1913), pp. 301 to 307. (10 cents)

(NATIONAL STANDARD)

The committee has formulated specifications for 2 $\frac{1}{2}$ -, 3-, 3 $\frac{1}{2}$ - and 4-in. hose couplings, and for converting non-standard couplings.

**Paper 1399**

**REPORT OF COMMITTEE ON STANDARDIZATION OF PIPE-THREAD  
GAGES**

Presented at New York, December 1913. Printed in Trans. Am. Soc.  
M. E., Vol. 35 (1913), pp. 309 to 311. 1 table. (10 cents)

The purpose of the committee was to fix manufacturing limits for the use of the Briggs standard pipe-thread gages when tapping fittings or flanges, so that pipe cut to the Briggs standard might always enter a definite number of turns. A table of sizes and tolerances is given.

Paper 1403

REPORT OF SUB-COMMITTEE ON HOISTING AND CONVEYING

Presented and discussed at New York, December 1913. Printed in Trans.  
Am. Soc. M. E., Vol. 35 (1913), pp. 405 to 416. (10 cents)

The committee reviews developments in hoisting and conveying, and makes preliminary recommendations as to boilers, electric equipment, safety, foundations, depreciation, wheels, brakes, wire rope, ethics.

Paper 1429

REPORT OF COMMITTEE ON CODE OF ETHICS

Recommended by letter ballot of the membership of the Society. Reported at St. Paul-Minneapolis, June 1914. Printed in Trans. Am. Soc. M. E., Vol. 36 (1914), pp. 23 to 27. (10 cents)

The committee's recommendations deal with general principles, engineers' relations to client or employer, ownership of engineering records and data, engineers' relations to the public and to the engineering fraternity.

Paper 1430

REPORT OF COMMITTEE ON STANDARDIZATION OF FLANGES ON THE  
AMERICAN STANDARD FOR PIPE FLANGES, FITTINGS AND  
THEIR BOLTING

*Including Schedule of Standard Pipe Flanges and Fittings from 1  
In. to 100 In., 125 Lb. Working Pressure, and Schedule  
of Extra Heavy Pipe Flanges and Fittings from  
1 In. to 48 In., 250 Lb. Working Pressure*

Presented at New York, December 1913, and subsequently revised. Printed in Trans. Am. Soc. M. E., Vol. 36 (1914), pp. 29 to 57. 4 tables, 32 figs. Recommended to become effective January 1, 1914, and revised to March 7 and 20, 1914. (40 cents)

The American Standard is a compromise between the 1912 U. S. Standard and the Manufacturers' Standard adopted in 1912, and combines the advantages of both. The standard-weight or low-pressure sizes have been extended from 30 in. to 100 in., and the extra-heavy or high-pressure sizes from 24 in. to 48 in.

Paper 1448

REPORT OF SUB-COMMITTEE ON RAILROADS ON STEAM LOCOMOTIVES  
OF TODAY

Presented and discussed at New York, December 1914. Printed in Trans. Am. Soc. M. E., Vol. 36 (1914), pp. 483 to 534. (40 cents)

This report and discussion is devoted to the progress of the steam locomotive, especially during the ten years since the Louisiana Purchase Exposition tests reported in Paper 1109.

Paper 1450

REPORT OF THE COMMITTEE ON RESOLUTIONS OF THE SNOW REMOVAL CONFERENCE HELD IN PHILADELPHIA, APRIL 16 AND 17, 1914

Presented and discussed at New York, December 1914. Printed in Trans.  
Am. Soc. M. E., Vol. 36 (1914), pp. 551 to 569

The committee reviews the methods adopted for the removal of snow, deals with the particular cases of Philadelphia, New York, Boston, Scranton, the Public Service Railway Company of New Jersey and the Pennsylvania Railroad Company, and in conclusion makes eight recommendations on the subject.

Paper 1468

REPORT OF COMMITTEE ON STANDARD CROSS-SECTIONS AND SYMBOLS

Presented and discussed at New York, December 1914. Printed in Trans.  
Am. Soc. M. E., Vol. 36 (1914), pp. 965 to 976. 2 figs. (10 cents)

The committee recommends a standard method of indicating materials in cross-section and submits standard cross-sections for 19 materials. Fig. 1 shows the recommended forms of cross-hatching.

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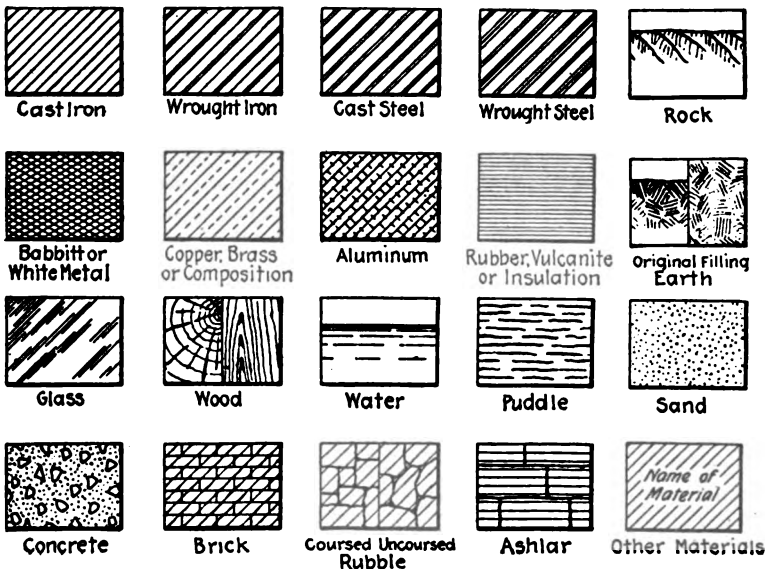


FIG. 1 RECOMMENDED FORMS OF CROSS-HATCHING

## Paper 1469

**REPORT OF COMMITTEE<sup>1</sup> TO FORMULATE STANDARD SPECIFICATIONS  
FOR THE CONSTRUCTION OF STEAM BOILERS AND OTHER  
PRESSURE VESSELS AND FOR THEIR CARE IN SERVICE**

Presented at New York, December 1914. Approved by the Council Feb. 13, 1915. Printed in Trans. Am. Soc. M. E., Vol. 36 (1914), pp. 977 to 1086. 16 tables, 30 figs. and 4 indexes. (80 cents paper, \$1.60 cloth)

The committee was appointed on September 15, 1911, and submits its final report, the primary object of which is to secure safe boilers. When the report was accepted, the Boiler Code Committee was reappointed as a permanent committee and now meets monthly for the purpose of considering communications relative to the Boiler Code. The results are published in THE JOURNAL each month. The following is a résumé of the contents of the Boiler Code:

**New Installations**

**Power Boilers**

Specifications for Boiler Plate Steel, Boiler Rivet Steel, Staybolt Steel, Steel Castings, Gray Iron Castings, Malleable Castings, Boiler Rivet Iron, Staybolt Iron, Refined Wrought-Iron Bars, Boiler Tubes

**Heating Boilers**

**Existing Installations**

**Appendix**

Efficiency of Joints, Braced and Stayed Surfaces, Safety Valves, Fusible Plugs.

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## Paper 1474

**REPORT OF COMMITTEE ON STANDARDIZATION OF SPECIAL THREADS  
FOR FIXTURES AND FITTINGS, ON ROLLED THREADS FOR  
SCREW SHELLS OF ELECTRIC SOCKETS AND LAMP  
BASES**

Presented at Buffalo, N. Y., June 1915. Printed in Trans. Am. Soc. M. E., Vol. 37 (1915), pp. 25 to 29. 4 figs. (See also Paper 1525.) (10 cents)

The report gives standard dimensions of socket screw shells and lamp-base screw shells for miniature, candelabra, medium and mogul sizes, go and not-go.

## Paper 1523

**REPORT OF SUB-COMMITTEE ON MACHINE SHOP PRACTICE ON  
SAFETY CODE FOR THE USE AND CARE OF ABRASIVE WHEELS**

Presented and discussed at New York, December 1915. Printed in Trans. Am. Soc. M. E., Vol. 37 (1915), pp. 1221 to 1230. 4 tables. (10 cents)

In nearly all vital points a code recommended by the Abrasive Wheel Manufacturers was approved, and forms the basis of the present code. The safety devices are considered under the three general heads: protection flanges, protection hoods and protection chucks.

Table 2, giving revolutions per minute for various sizes of grinding wheels to give the peripheral speed in feet per minute, is included in this report.

<sup>1</sup> The Boiler Code Committee.



TABLE 2 R. P. M. FOR VARIOUS SIZES OF GRINDING WHEELS TO GIVE  
PERIPHERAL SPEED IN FT. PER MIN.

Diam. of Wheel in In.	4,000	4,500	5,000	5,500	6,000	6,500
1	15.279	17.200	19.099	21.000	22.918	24.850
2	7.639	8.590	9.549	10.500	11.459	12.420
3	5.093	5.725	6.366	7.000	7.639	8.270
4	3.820	4.295	4.775	5.250	5.730	6.205
5	3.056	3.440	3.820	4.200	4.584	4.970
6	2.546	2.865	3.183	3.500	3.820	4.140
7	2.183	2.455	2.728	3.000	3.274	3.550
8	1.910	2.150	2.387	2.635	2.865	3.100
10	1.528	1.720	1.910	2.100	2.292	2.485
12	1.273	1.453	1.592	1.750	1.910	2.070
14	1.091	1.228	1.364	1.500	1.637	1.773
16	.955	1.075	1.194	1.314	1.432	1.552
18	.849	.957	1.061	1.167	1.273	1.380
20	.764	.860	.955	1.050	1.146	1.241
22	.694	.782	.868	.952	1.042	1.128
24	.637	.716	.796	.876	.955	1.035
26	.586	.661	.733	.809	.879	.955
28	.546	.614	.683	.749	.819	.887
30	.509	.573	.637	.700	.764	.827
32	.477	.537	.596	.657	.716	.776
34	.449	.506	.561	.618	.674	.730
36	.424	.477	.531	.584	.637	.689
38	.402	.453	.503	.553	.603	.653
40	.382	.430	.478	.525	.573	.621
42	.364	.409	.455	.500	.546	.591
44	.347	.391	.434	.477	.521	.564
46	.332	.374	.415	.456	.498	.539
48	.318	.358	.397	.438	.477	.517
50	.306	.344	.383	.420	.459	.497
52	.294	.331	.369	.404	.441	.487
54	.283	.318	.354	.389	.425	.459
56	.273	.307	.341	.366	.410	.443
58	.264	.296	.330	.354	.396	.428
60	.255	.277	.319	.350	.383	.414

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## Paper 1525

REPORT OF COMMITTEE ON STANDARDIZATION OF SPECIAL THREADS  
FOR FIXTURES AND FITTINGS, ON STRAIGHT PIPE THREADS

Presented at New York, December 1915. Printed in Trans. Am. Soc.  
M. E., Vol. 37 (1915), pp. 1263 to 1272. 5 tables, 3 figs. (See also Paper  
1474.) (10 cents)

This report recommends standards for outside, pitch, and root diameters and  
tolerances of straight pipe threads. The proportions recommended are shown  
in Fig. 2 and in Table 3.

## Paper 1526

REPORT OF POWER TEST COMMITTEE ON RULES FOR CONDUCTING  
PERFORMANCE TEST OF POWER PLANT APPARATUS

Presented at New York, December 1915. Printed in Trans. Am. Soc.  
M. E., Vol. 37 (1915), pp. 1273 to 1458. 22 tables, 27 figs., 38 appendices.  
Index. (Supersedes all previous codes for testing power-plant apparatus.)  
(\$1.40 paper, \$2.00 cloth)

## (POWER TEST CODE)

The following is a résumé of the contents of the Power Test Code:

## General Matters

- 1 Instructions regarding tests, object, preparations, miscellaneous  
instructions, operating conditions, records, plotting data and  
curves, report

TABLE 3 AMERICAN BRIGGS PIPE STANDARD LOCKNUT THREADS AND BASIC STRAIGHT PIPE SIZES

Pipe Size In.	Threads per In.	Depth Thread $\frac{0.8}{n}$	Pitch Diameter of End of Pipe	Pitch Diameter at Notch of Basic Straight	Maximum Pitch Diameter of Straight Male Locknut Thread	Minimum Pitch Diameter of Outside Female Locknut Thread	Outside Diameter of Pipe	Thickness Full Briggs Ring	Thickness American Briggs Ring	Pitch Diameter at Large End	Difference in Diameter One Thread
	$n$		A	B	$C_1$	$C_2$	D	E	F	G	H
$\frac{1}{8}$	27	0.02962	0.36350	0.37475	0.38400	0.38632	0.405	0.2638	0.180	0.37999	0.00232
$\frac{1}{4}$	18	0.04444	0.47739	0.48989	0.50378	0.50725	0.540	0.4018	0.200	0.50250	0.00347
$\frac{3}{8}$	18	0.04444	0.61201	0.62701	0.64090	0.64437	0.675	0.4078	0.240	0.63750	0.00347
$\frac{1}{2}$	14	0.05714	0.75813	0.77843	0.79628	0.80075	0.840	0.5337	0.320	0.79179	0.00446
$\frac{3}{4}$	14	0.05714	0.96768	0.98866	1.00671	1.01118	1.050	0.5457	0.339	1.00179	0.00446
1	11½	0.06956	1.21303	1.23863	1.26036	1.26580	1.315	0.6828	0.400	1.25630	0.00543
$1\frac{1}{4}$	11½	0.06956	1.55713	1.58338	1.60511	1.61055	1.660	0.7098	0.420	1.60132	0.00543
$1\frac{1}{2}$	11½	0.06956	1.79609	1.82234	1.84407	1.84951	1.900	0.7235	0.420	1.84131	0.00543
2	8	0.09375	2.26902	2.29627	2.31801	2.32344	2.375	0.7565	0.436	2.31630	0.00543
$2\frac{1}{2}$	8	0.10000	2.71954	2.76216	2.79341	2.80122	2.875	1.1375	0.682	2.79063	0.00781
3	8	0.10000	3.34063	3.38850	3.41975	3.42756	3.500	1.2000	0.766	3.41563	0.00781
$3\frac{1}{2}$	8	0.10000	3.83750	3.88881	3.92006	3.92787	4.000	1.2500	0.821	3.91563	0.00781
4	8	0.10000	4.33438	4.38713	4.41838	4.42619	4.500	1.3000	0.844	4.41563	0.00781
$4\frac{1}{2}$	8	0.10000	4.83125	4.88593	4.91718	4.92499	5.000	1.3500	0.875	4.91563	0.00781
5	8	0.10000	5.39074	5.44803	5.48055	5.48836	5.563	1.4063	0.937	5.47863	0.00781
6	8	0.10000	6.44610	6.50297	6.53722	6.54503	6.625	1.5125	0.958	6.54063	0.00781
7	8	0.10000	7.43985	7.50235	7.53360	7.54141	7.625	1.6125	1.000	7.54063	0.00781
8	8	0.10000	8.43865	8.50003	8.53128	8.53909	8.625	1.7125	1.063	8.54063	0.00781
9	8	0.10000	9.42735	9.49797	9.52922	9.53703	9.625	1.8125	1.130	9.54063	0.00781
10	8	0.10000	10.54532	10.62094	10.65219	10.66000	10.750	1.9250	1.210	10.64063	0.00781

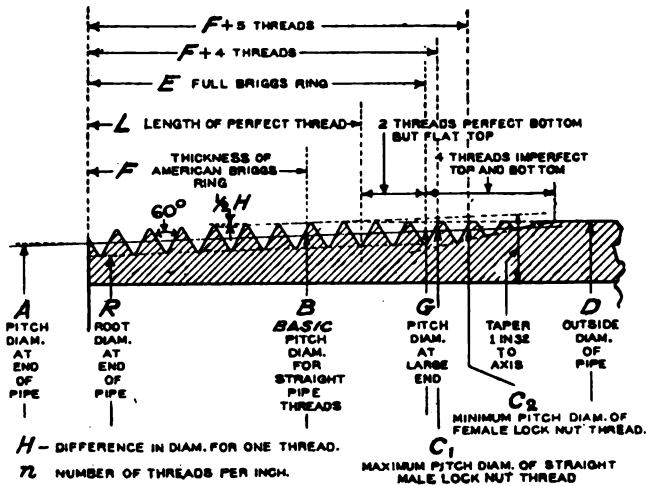


FIG. 2 BASIC STRAIGHT PIPE SIZES

- 2 Standards relating to capacity, efficiency and economy
- 3 Rules for sampling and drying coal and ash, and sampling steam and gases

#### Individual Codes

- 4 Boiler code
- 5 Reciprocating steam engine code
- 6 Steam turbine code
- 7 Pumping machinery code
- 8 Code for compressors, blowers, fans
- 9 Code for complex steam power plant
- 10 Locomotive codes
- 11 Gas producer code
- 12 Gas and oil engine code
- 13 Waterwheel code
- Appendices.

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#### Paper 1572

### REPORT OF SUB-COMMITTEE ON PROTECTION OF INDUSTRIAL WORKERS, ON CODE OF SAFETY STANDARDS FOR CRANES

Presented at New York, December 1916. Printed in Trans. Am. Soc. M. E., Vol. 38 (1916), pp. 1205 to 1212. 1 fig. (10 cents)

The standards in this report apply to cranes which are regularly used in and form part of a permanent industrial plant. In addition to electric traveling cranes, the regulations cover gib cranes, monorail cranes, hand-power cranes, and other hoisting apparatus of a similar nature, insofar as the various sections apply.

The report contains twenty recommendations on general construction, twenty-two rules for operators, six rules for floormen and six rules for repairmen. It also includes an illustrated code of manual signals for crane operation.



**DATA SECTION  
PART II**

**Engineering Data**

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**Pages 461-472**

On the following pages are engineering data selected from the Transactions, Volume 38, 1916, and from The Journal, 1916, of The American Society of Mechanical Engineers.

The material from the Transactions includes original data derived by the authors of papers presented to the Society and embodied in those papers.

The data from The Journal are taken from the Engineering Survey Section, which includes abstracts from domestic and foreign periodicals and society publications, and the source of information is given in each instance.

With but possibly two or three exceptions, these data have not as yet appeared in any engineering handbook.

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## STRENGTH OF MATERIALS USED IN AEROPLANE CONSTRUCTION

Table 1 gives results obtained from tests upon several species of wood, and records, in addition to the flexural and compressive resistances, the moduli of elasticity, number of rings per inch, and moisture content.

TABLE 1 PHYSICAL PROPERTIES OF WOODS USED IN AEROPLANE CONSTRUCTION

Material	Rings per in., over	Per cent moisture, under	Wt. per cu. ft. lb.	Modulus of rupture	Compressive strength, lb. per sq. in.	Modulus of elas. (flexure)
Virginia spruce	12	15	21	7,460	4,720	1,289,000
Cedar, white	15-25	5-7	25	16,010	9,050	1,920,000
Alaska spruce	16	..	..	11,200	7,510	1,512,000
Sitka spruce	10-25	5-13	28	11,000	6,610	1,538,000
Tamarack	...	8	29	...	6,649	....

In aeroplane construction there has been a tendency to use steel tubing of extremely small wall thickness, and apparently it has been assumed that the greater the radius of gyration of section the greater would be the resistance to stress, regardless of wall thickness. Table 2 shows the results of a number of tests in which the outside diameter of the tube was kept constant, and the wall thickness,

TABLE 2 DATA OF TESTS ON STEEL TUBING  
3½ Per Cent Nickel Steel

Torsion Tests					
Specimen No.	Tube diameter, in.	Wall thickness, in.	Fiber stress at E. L.	Fiber stress maximum	Modulus
1	1.180	.022	...	38,820	9,900,000
2	1.180	.040	39,200	52,920	11,600,000
3	1.182	.061	41,000	61,210	11,700,000
4	1.184	.076	49,700	74,000	11,000,000
5a	1.185	.096	43,500	75,620	11,900,000

Specimen No.	Flexure tests		Tension tests	
	Fiber stress at E. L.	Fiber stress maximum	Yield point	Ultimate resistance
1	45,100	68,400	57,540	83,285
2	69,000	127,100	68,470	102,800
3	85,790	127,920	80,570	100,400
4	78,380	136,000	76,510	116,580
5a	94,300	139,400	75,700	117,220

starting with approximately 0.02 in., was increased by increments of 0.02 in. up to 0.10 in. It was found that the fiber stresses developed by the tubing increased with increase of wall thickness and that a wall thickness of about 5 per cent of the outside diameter develops the full strength of the material of which the tubes are composed.

The use of very thin-walled tubes with wall thicknesses less than 5 per cent of the outside diameter is objectionable, because it disposes the material in a manner which does not permit of the development of the full fiber stress, because the chances of local deformation are very great in such cases, and finally because light-walled tubes might fail with particular ease if rusted.

[*Journal*, December 1916, p. 1033]

[Source: *Aero World*, October 1916, p. 46]



## THE LATERAL BENDING RESISTANCE OF BOLTS AND LAG SCREWS

Lag screws and bolts subjected to bending by transverse loads as in Fig. 1, have load-deflection curves like that of Fig. 2. During the first stage *ab* in

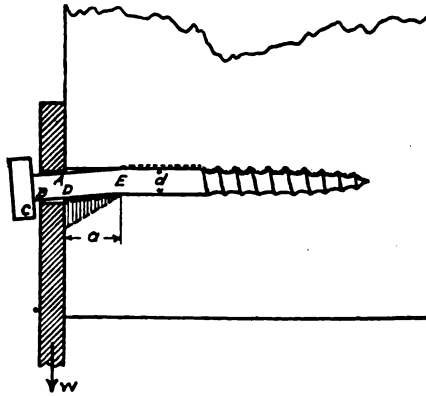


FIG. 1 LATERAL BENDING OF BOLTS AND LAG SCREWS

Fig. 2, the load concentrates itself at point *A*, Fig. 1, and the bolt beds itself firmly in the bolt hole if the initial fit is imperfect. During the second stage *bc* the increasing load is carried by the elastic resistance of the wood fibers at *D* and the metal at *E*. The load-deflection curve is approximately straight during this portion of the test. This stage is terminated at the yield point *c* by the

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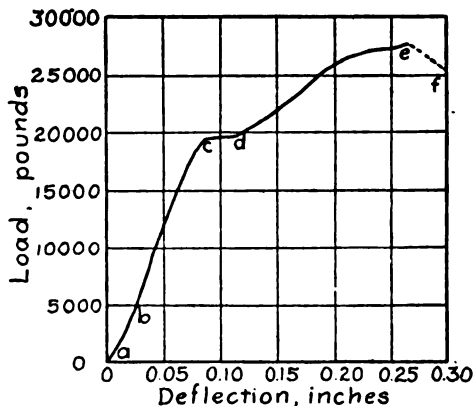


FIG. 2 LOAD-DEFLECTION CURVE OF LAG SCREW LOADED AS IN FIG. 1

simultaneous yielding of the wood fibers at *D* and the metal fibers at *E*. During the third stage the deflection continues to increase with little or no change in the load. At the beginning of the fourth stage *de* the bolt makes contact at *B* or *C*. The load again increases during this stage up to the beginning of the final failure at *e*. The last stage *ef* represents the splitting of the wood or the starting or pulling out of the bolts or lag screws.

Letting  $W$  be the safe load allowed on a bolt or lag screw bending against wood fibers,  $P$  the safe allowable bearing stress on wood fibers, and  $E$  the safe allowable tensile stress for metal, the equation for the design of bolted or lag-screwed timber connections may then be written

$$W = 433d^2\sqrt{PE}$$

where  $d$  = diameter of bolt in inches. This equation should be used only for lag screws and bolts of circular cross-section, of metal having a well-defined yield point, and bearing endwise against the wood fibers.

[*Journal*, December 1916, p. 1038]

[Source: *The Rose Technic*, October 1916, p. 6]

### FLOW OF AIR AND STEAM THROUGH THIN-PLATE ORIFICES

For air,

$$Q = \frac{405A(P_1^2 - P_2^2)^{0.48}}{\sqrt{T}} \dots\dots\dots [1]$$

For dry saturated steam,

$$Q_1 = A(82.8 + 0.55P_2)(P_1^2 - P_2^2)^{0.48} \dots\dots\dots [2]$$

where  $Q$  = cu. ft. of air discharged per min. at 32 deg. fahr. and 14.7 lb. per sq. in. abs.

$Q_1$  = pounds of dry saturated steam per hour

$A$  = area of the orifice, sq. in.

$P_1$  = initial pressure before orifice, lb. per sq. in. abs.

$P_2$  = final pressure after orifice, lb. per sq. in. abs.

$T$  = absolute temperature of air entering orifice, deg. fahr.

Both formulæ are derived from experimental work, [1] being intended for computation of air flow under pressures from 15 to 100 lb. gage, while [2] is intended only for steam pressures slightly over and under atmospheric.

[Herbert B. Reynolds. *Trans.*, vol. 38, pp. 817 and 829]

### DEVIATION OF NATURAL GAS FROM BOYLE'S LAW

The universal custom in the natural-gas business has been to assume that the gas obeys Boyle's law, namely, that its volume at constant temperature varies inversely as its absolute pressure, or that the product of its volume and absolute pressure is a constant. This law, however, is not followed rigorously by natural gas, and the U. S. Bureau of Mines has found it desirable to develop a formula by means of which the deviation of any natural gas, at any pressure, can be determined from a simple analysis of the gas.

Suppose it is desired to determine the deviation at 40 atmospheres pressure of a gas having the following percentage composition:  $\text{CH}_4$ , 88.1;  $\text{C}_2\text{H}_6$ , 11.5;  $\text{N}_2$ , 0.4. At 40 atmos. the partial pressures will be as follows:

$$\text{For } \text{CH}_4 \quad P_1 = 0.881 \times 40 = 35.2$$

$$\text{C}_2\text{H}_6 \quad P_2 = 0.115 \times 40 = 4.6$$

$$\text{N}_2 \quad P_3 = 0.004 \times 40 = 0.2$$

According to the compressibility curves in Fig. 3, the deviations per atmosphere are

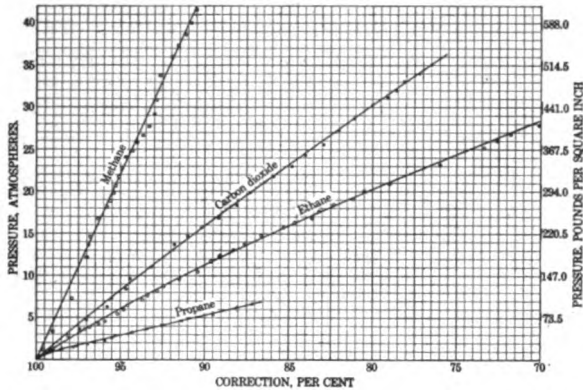


FIG. 3 COMPRESSIBILITY OF GASES FOUND IN NATURAL GAS

For  $\text{CH}_4$ , 0.228 ( $= a$ )      For  $\text{C}_2\text{H}_6$ , 1.90 ( $= c$ )  
 $\text{C}_2\text{H}_4$ , 0.900 ( $= b$ )       $\text{CO}_2$ , 0.67 ( $= d$ )  
 $\text{N}_2$  (not shown in figure), 0.01 ( $= e$ )

The total deviation  $D$  then becomes

$$D = aP_1 + bP_2 + cP_3 + \text{etc.}$$

and the deviation of the gas in question at a pressure of 40 atmos. is then

$$D = (0.228 \times 35.2) + (0.90 \times 4.6) + (0.2 \times 0.01) \\ = 8.03 + 4.14 + 0 = 12.17 \text{ per cent.}$$

[G. A. Burrell and I. W. Robertson. *Trans.*, vol. 38, p. 319]

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### DESIGN OF SUPERHEATERS

The amount of surface required for a superheater may be calculated by means of the formula

$$x = \frac{10S}{2(T - t) - S}$$

where  $x$  = superheating surface required per boiler hp., sq. ft.

$S$  = superheat required, deg. fahr.

$T$  = temperature of furnace gas at superheater, deg. fahr.

$t$  = temperature of saturated steam at boiler pressure, deg. fahr.

The value of  $T$  can be obtained from the equation  $(T - t)^{0.18} = 1/(0.172H + 0.294)$ , where  $H$  is the percentage of boiler heating surface between the furnace and superheater. For every one per cent of moisture in the saturated steam allow 15 per cent more superheater surface than found by the formula.

[*Journal*, October 1916, p. 841]

[Source: *Power*, August 8, 1916, p. 199]

### HEAT LOSS IN BOILER FURNACES FROM EXCESS AIR

The greatest and most neglected loss in the average boiler plant is from excess air. The curves, Fig. 4, show the magnitude of this loss at different  $\text{CO}_2$  per-

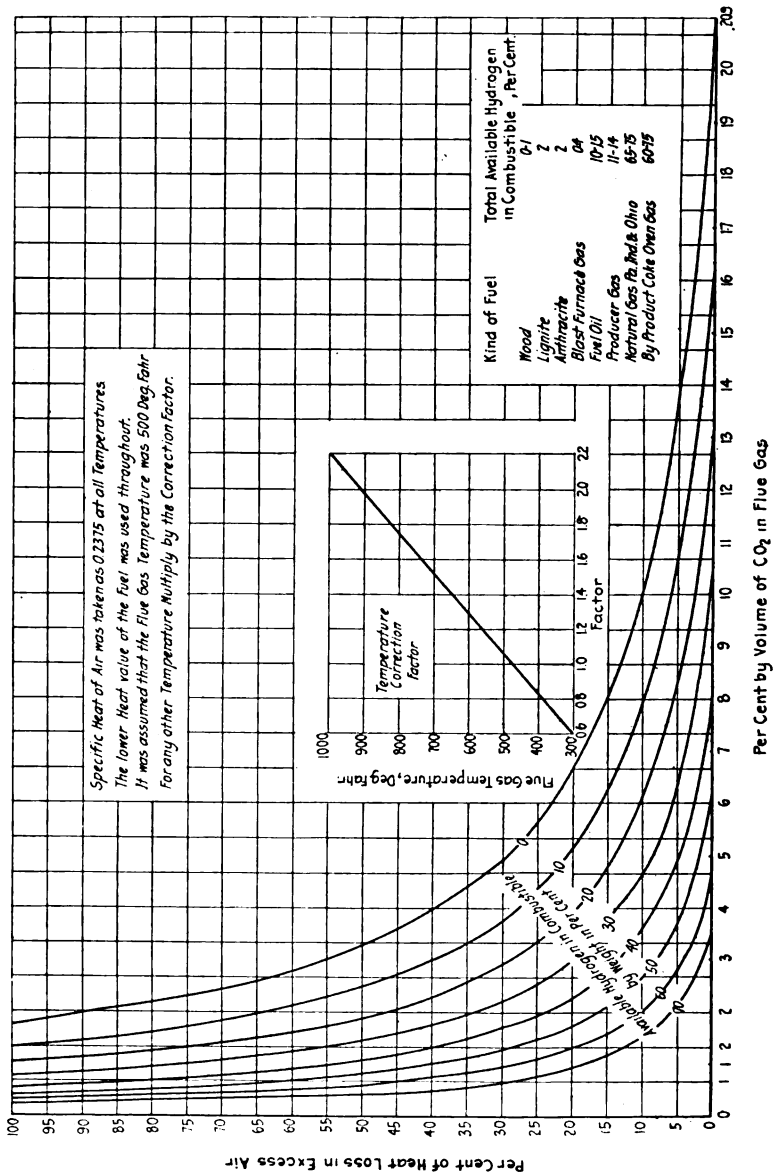


FIG. 4 HEAT LOSS FROM EXCESS AIR WITH FUELS OF DIFFERENT HYDROGEN CONTENT

centages and are applicable to any fuel, liquid, solid or gaseous, if its available hydrogen percentage is known.

The impression prevails that coal must be burned with about 50 per cent of excess air. Some authorities claim that going beyond 10 to 12 per cent  $\text{CO}_2$

the loss due to incomplete combustion will offset the saving effected by reducing the excess air. But some few up-to-date plants are averaging 17 per cent CO<sub>2</sub> with bituminous coal, without serious losses due to incomplete combustion. Fifty per cent excess air is more than is needed, and with proper furnace design not more than 10 per cent is required.

[Victor J. Azbe. *Trans.*, vol. 38, p. 721]

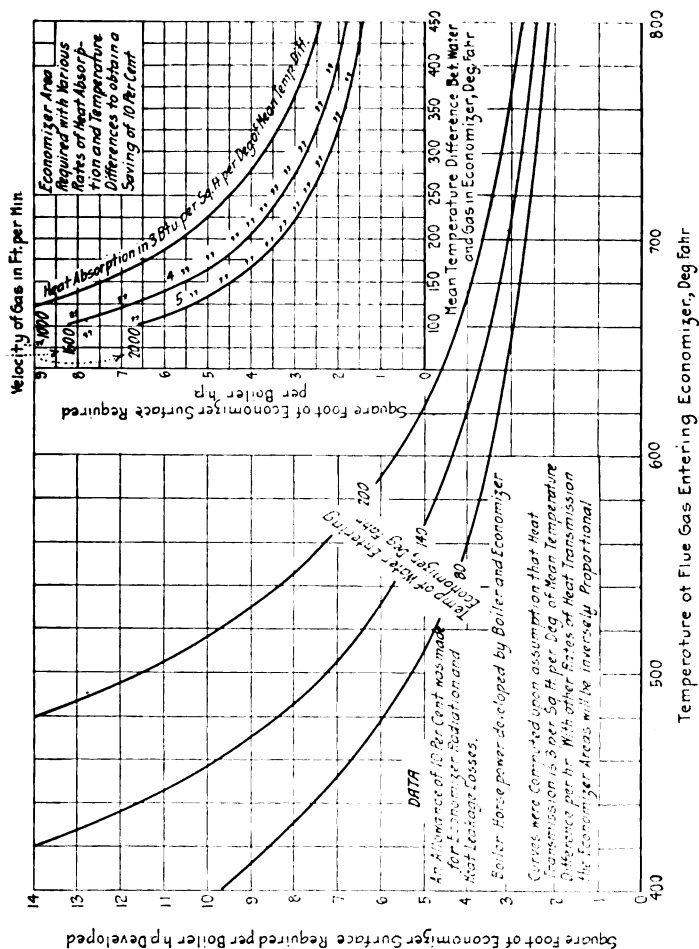


FIG. 5 ECONOMIZER SURFACE REQUIRED TO SAVE 10 PER CENT IN FUEL WITH DIFFERENT FLUE-GAS AND FEEDWATER TEMPERATURES

## CHARTS FOR ECONOMIZER CALCULATIONS

Fig. 5 shows the square feet of economizer area required per boiler horsepower to save 10 per cent in fuel with different flue-gas and feedwater temperatures. Figs. 6 and 7 also deal with economizer theory and practice.

[Victor J. Azbe. *Trans.*, vol. 38, p. 726]

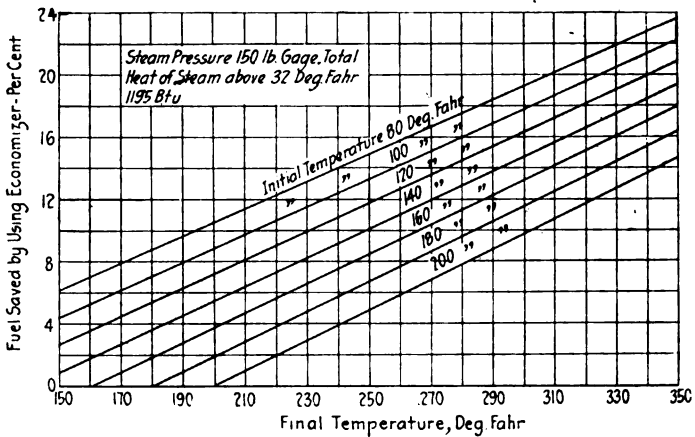


FIG. 6 SAVINGS FROM ECONOMIZERS WITH VARIOUS INITIAL AND FINAL FEEDWATER TEMPERATURES

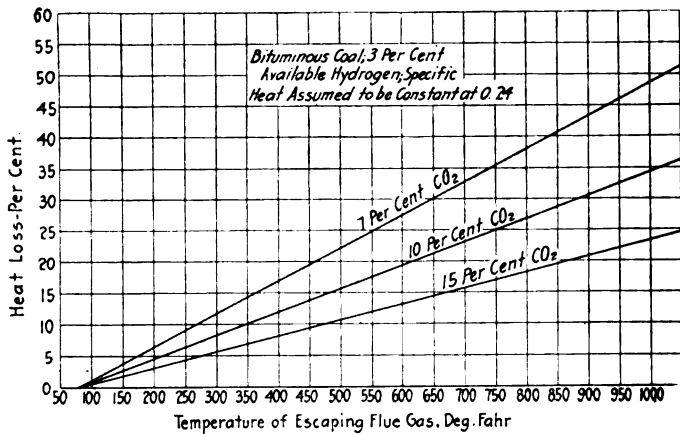


FIG. 7 HEAT LOSS IN DRY FLUE GAS WITH VARIOUS CO<sub>2</sub> PERCENTAGES AND DIFFERENT UPTAKE TEMPERATURES

### THE PROPORTIONING OF SURFACE CONDENSERS

In Mr. George A. Orrok's method of designing surface condensers the following procedure is employed:

$P_v$  = absolute pressure in condenser = 29.92 — (vacuum + 0.2 in.)

$t_s$  = temperature of steam corresponding to vacuum

$t_0$  = initial temperature of condensing water

$t_1$  = final temperature of condensing water =  $t_s - 5^\circ$  for close work, ordinarily =  $t_s - (7^\circ \text{ to } 10^\circ)$

$\lambda$  = total heat of steam at  $t_s$

$q$  = heat of the liquid at  $t_s$

Then ratio of condensing water to steam condensed is

$$R = \frac{\lambda - q}{t_1 - t_0}$$

Also, pounds of steam condensed per hour =  $W$ , and weight of condensing water used =  $Q = WR$ .

One-inch tubes (No. 18 B. W. G.) being taken as standard on account of advantages generally conceded to that size, the number required in one pass =  $n = Q \div 990 V_w$ , where  $V_w$  is the velocity of flow, averaging 8 ft. per sec. (7 to 10 ft.).

The length of water travel ( $l$ ), or the total tube length, may be found from

$$l = \frac{30.8Q}{325 V_w^{0.4} n} [(t_s - t_0)^{0.125} - (t_s - t_1)^{0.125}]$$

and the total tube surface ( $S$ ) from  $S = 0.262 nl$ .

The cross-sectional area of the condenser (sq. ft.) is equal to  $(n \times \text{number of passes}) \div 60$ , where 60 is the average number of tubes occupying 1 sq. ft. of tube-plate area. The length of the condenser =  $L = (l/m) + \text{depth of water boxes}$ , where  $m$  = number of passes.

[George A. Orrok. *Trans.*, vol. 38, p. 467]

## HEAT TRANSMISSION AND GAS FLOW IN ECONOMIZERS

The relations between rate of gas flow through economizers, temperature of gases and average coefficient of heat transmission are shown in Fig. 8, compiled

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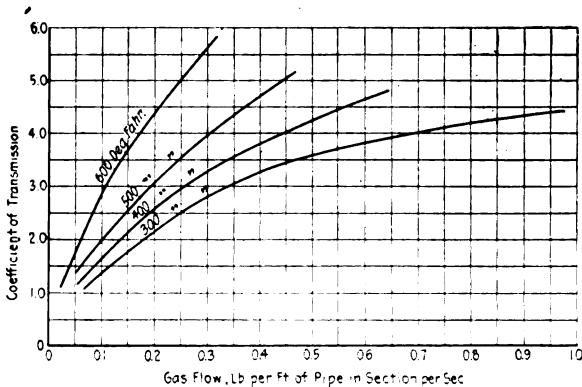


FIG. 8 RELATIONS BETWEEN RATE OF GAS FLOW THROUGH ECONOMIZERS, TEMPERATURE OF GASES, AND COEFFICIENT OF HEAT TRANSMISSION

from tests upon a large number of commercial economizers in various conditions of actual service. The temperatures indicated are the mean temperatures of the gases, that is, the temperature of the gases entering the economizer plus the temperature of the gases leaving the economizer, divided by two. The rate of gas flow is stated in pounds of gases per foot of pipe in a section per second;

that is, if there are ten pipes in a section of the economizer and each pipe is 10 ft. long, there will be 100 ft. of pipe per section, and the total gas flow per second would be divided by 100 to obtain the quantity set off on the horizontal axis.

[Geo. H. Gibson. *Trans.*, vol. 38, p. 757]

### GAS AND OIL TRACTOR POWER COSTS

Tests carried out at Kansas State Agricultural College on farm traction engines employing internal-combustion motors give the results tabulated below. Twelve engines ranging from 16 to 65 b.hp. were tested, but those of Group II, consisting of four engines developing from 28 to 51 b.hp., were operated on gasoline only, at costs about three per cent under those for Group III.

Per cent Load	COST PER BRAKE-HORSEPOWER-HOUR IN CENTS WITH								
	60° Baumé Gasoline at Prices per Gallon (in Cents) of					45° Baumé Kerosene at Prices per Gallon (in Cents) of			
	9	12	15	18	21	5	7	9	11
Group I <sup>1</sup>									
25	2.72	3.62	4.53	5.43	6.34	1.49	2.10	2.70	3.30
50	1.68	2.24	2.80	3.36	3.93	0.95	1.33	1.71	2.09
75	1.38	1.83	2.30	2.75	3.22	0.78	1.10	1.41	1.71
100	1.25	1.67	2.09	2.51	2.93	0.70	0.98	1.26	1.54
Group III <sup>2</sup>									
25	2.16	2.88	3.59	4.31	5.03	1.37	1.92	2.47	3.02
50	1.37	1.82	2.27	2.78	3.18	0.89	1.25	1.61	1.97
75	1.14	1.53	1.90	2.29	2.67	0.76	1.06	1.37	1.67
100	1.07	1.43	1.78	2.14	2.50	0.73	1.03	1.32	1.61

<sup>1</sup> Motors developing 15 to 26 b.hp. on full load. <sup>2</sup> Motors developing over 51 b.hp. on full load.

[A. A. Potter and W. A. Buck. *Trans.*, vol. 38, p. 1001]

### THE FLOW OF SUPERHEATED AMMONIA IN PIPES

From results of tests made at the Massachusetts Institute of Technology the following formula was deduced which is applicable to pipe from 1 in. to 2 in. in diameter:

$$W = 1.6D(100d/L)^{0.818}(b^2/2.25)$$

where  $D$  = density at entrance

$L$  = length of pipe, ft.

$d$  = pressure drop for length  $L$ , lb.

$W$  = weight per second, lb.

$b$  = diameter of pipe, in.

This formula, if applied in figuring the discharge capacity of 100 ft. of pipe on the outlet of a safety valve having inlet and outlet pipes of the size called for by the refrigeration regulations in force in Massachusetts, shows that in every case the pipe has a discharging capacity at least 50 per cent greater than the rated capacity of the valve.

[*Journal*, November 1916, p. 939]

[Source: A. S. R. E. *Journal*, September 1916, p. 26]



## CELITE AS A HEAT INSULATOR

Celite is a material possessing remarkable non-conducting properties, so-called on account of its extremely cellular nature; it is a mineral of a highly siliceous composition and of very light weight, and occurs on the Pacific Coast in an exceptionally pure state. It is composed of numerous hollow cells, and weighs in its natural rock form, air-dried, from 25 to 30 lb. per cu. ft. When ground properly it weighs but 8 lb. per cu. ft. and has a thermal insulating power of about 9 to 12 times the insulating power of ordinary firebrick. In other words, a 1-in. layer of this material is the equivalent in insulating value of from 9 to 12 in. of firebrick. Being almost pure silica, its melting point is high, 2930 deg. fahr. (1610 deg. cent.) as reported by the U. S. Bureau of Standards, and it can be subjected to high temperatures without fear of alteration.

Bricks and blocks of various sizes and shapes are prepared by sawing the natural material by means of gang saws. Standard 9-in. straight bricks made from natural celite weigh from 1½ to 2 lb. each and are equivalent in insulating value to many times their thickness of ordinary firebrick. In crushing strength these bricks withstand over 400 lb. per sq. in. and are sufficiently strong to stand transportation and handling.

[P. A. Boeck. *Journal*, August 1916, p. 639]

## POWER REQUIREMENTS FOR WIRE DRAWING

A formula which gives satisfactory results in practical work is the formula of Victor E. Edwards for rolling-mill operations, as follows:

$$\text{Horsepower} = STF \log (A/a)$$

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where  $S$  = tensile strength of stock before the draft, lb. per sq. in.

$T$  = tons delivered per minute

$A$  = area of section before the draft

$a$  = area of section after the draft

$F$  = a variable factor.

The author has analyzed results obtained by this formula in connection with motor readings and finds that the value of  $F$  varies inversely with the percentage of reduction  $P$ . He gives a straight-line chart for its determination which shows that  $F = 0.129 - 0.0009P$ . The formula may also be applied to continuous wire-drawing operations in which many reductions are performed simultaneously on the same wire. In such cases  $T$  is figured from the product of one die only, while  $S$  and  $F$  are averages. The formula is good for round wires and rods only. Hexagons and squares conform to these figures more or less; other shapes do not.

[*Journal*, January 1916, p. 94]

[Source: *The Blast Furnace and Steel Plant*, December 1915, p. 1031]

## RECOMMENDED SPEEDS FOR GRINDING WHEELS

A speed of 5000 peripheral feet per minute is recommended as the standard operating speed for vitrified and silicate straight wheels, tapered wheels and shapes other than those known as cup and cylinder wheels, which are used on bench, floor, swing-frame and other machines for rough grinding. Speeds exceeding 5000 feet may be used upon recommendation of the wheel manufacturer, but in no case shall a speed of 6500 peripheral feet per minute be exceeded.

A speed of 4500 peripheral feet per minute is recommended as the standard operating speed for vitrified and silicate wheels of the cup and cylinder shape, used on bench, floor, swing-frame and other machines for rough grinding. Speeds exceeding 4500 peripheral feet per minute may be used upon recommendation of the wheel manufacturer, but in no case shall 5500 peripheral feet per minute be exceeded.

For elastic, vulcanite and wheels of other organic bonds, the recommendation of individual wheel manufacturers shall be followed.

For precision grinding an operating speed of 6500 peripheral feet per minute may be recommended. Speeds higher than 6500 peripheral feet per minute can be used only upon recommendation of the wheel manufacturer.

Table 2, which is given in the abstracts of standards reports preceding this section, gives revolutions per minute for various sizes of wheels for the peripheral velocities in feet per minute at the head of each column.

[*Journal, February 1916, p. 123*]

[*From A. S. M. E. Safety Code for the Use and Care of Abrasive Wheels*]

## A UNIVERSAL SPEED SERIES FOR MACHINE TOOLS

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It being first agreed that a geometrical series of speeds should be provided for any one machine, Mr. Carl G. Barth's idea is that a universal speed series should be adopted by all machine-tool builders for all machines such as lathes, boring mills, milling machines, drill presses, etc., that are provided with a spindle for either the work or the cutting tool, and which, except in the case of certain single-purpose machines not included in this discussion, may be rotated at different speeds; for our present knowledge does not warrant us in asserting or assuming that a progression of speeds for one kind of these machines should have a lesser or a greater constant ratio than for any other kind; and, evidently, if there is no reason for making them different, there is every reason for making them just alike. The question then becomes, what should be the constant ratio of such a universal geometrical progression of speeds?

Years ago Mr. Barth adopted the ratio 1.2, but later modified it to 1.1892, which made every fourth term a power of 2, as follows:

1.000	1.1892	1.4142	1.6818
2.000	2.3784	2.8284	3.3636
4.000	4.7568	5.6568	6.7272
8.000	etc.	....	....

It may be, however, that the majority of machine-tool builders would deem a somewhat larger ratio preferable in order to obtain a larger final ratio between the slowest and the fastest speeds of a machine which, for one consideration or other, may have to be arranged with a rather limited total number of speeds, as, for instance, a lathe with a single back-gear reduction, or a small drill press or milling machine with no back-gear reduction at all. A possibly more generally acceptable progression would be one with the constant ratio  $\sqrt[4]{2} = 1.2599$ . There are, however, strong reasons for favoring the first progression given, from which under certain conditions every other term may be omitted.

[*Carl G. Barth. Trans., vol. 38, pp. 898-900*]

**DIRECTORY SECTION  
PART I**

**Consulting Engineers'  
Directory**

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**Pages 474-480**

# CONSULTING ENGINEERS' DIRECTORY

Compiled from the membership of The American  
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## A

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Toltz Engineering Co., 1410 Pioneer Bldg., St. Paul, Minn.

### ARCHITECTURAL

Allen & Co., Albert M., 1900 Euclid Ave., Cleveland, O.  
Ancona, J. F., Cutler Bldg., Rochester, N. Y.  
Christie, William W., 140 Market St., Paterson, N. J.  
Green Co., Samuel M., 293 Bridge St., Springfield, Mass.  
Irvin & Co., Richard, 308 Union Natl. Bank Bldg., Pittsburgh, Pa.  
Johnson, Louis L., Attica, Ind.

### AUTOMATIC MACHINERY

Clyne, R. G., 700-704 Columbia Bldg., St. Louis, Mo.  
Monte, Robert Alva, 127 W. Westfield Ave., Roselle Park, N. J.

### AUTOMOTIVE

Guthrie, James, Erie Bldg., Cleveland, O.  
Myers, Cornelius T., 117 W. Fort St., Detroit, Mich.

### AVIATION

Monte, Robert Alva, 127 W. Westfield Ave., Roselle Park, N. J.

## B

### BONUS SYSTEMS

Arison, Edgar E., 1535 Railway Exchange, Chicago, Ill.  
Parsons Corp'n, G. K., 120 Broadway, New York.

### BUILDING EQUIPMENT

#### —Electrical

Meyer, Jr., Henry C., and Jones, Bassett, Assoc., 101 Park Ave., New York.

#### —Mechanical

Allan, C. D., 230 S. La Salle St., Chicago, Ill.  
Jellett Co., Stewart A., Real Estate Trust Bldg., Philadelphia, Pa.  
Meyer, Jr., Henry C., and Jones, Bassett, Assoc., 101 Park Ave., New York.

## C

### CABLEWAYS

Hays, Lewis T., 1054-4th Ave., S., Seattle, Wash.

### CHEMICAL

Brown, Herman E., 7 Wall St., Kingston, N. Y.  
Little, Inc., Arthur D., 93 Broad St., Boston, Mass.  
Mantius, Otto, 233 Broadway, New York.  
Meade, Richard K., 607-610 Law Bldg., Baltimore, Md.  
Moulton Engineering Corp'n, 534 Congress St., Portland, Maine.  
Wayte, Inc., W. J., 1 Liberty St., New York.

### CHEMICAL WORKS

Cannon-Swenson Co., 53 W. Jackson Blvd., Chicago, Ill.

### CIVIL

Allen, Raymond C., Manchester, Mass.  
Arnold Co., 105 So. La Salle St., Chicago, Ill.  
Elliott & Harman Engineering Co., 144 Predonia Ave., Peoria, Ill.  
Gerhurd, Wm. Paul, Room 826, 30 E. 42nd St., New York.  
Knowles, Morris, 1200 Jones Bldg., Pittsburgh, Pa.  
LaSalle Engineering Co., 337 W. Madison St., Chicago, Ill.  
Metcalf & Eddy, 14 Beacon St., Boston, Mass.  
Moran, Daniel B., 55 Liberty St., New York.  
Orbison, Thomas W., Appleton, Wis.  
Pierce, Frederic E., 35 Nassau St., New York.  
Seaton, R. A., K. S. A. C., Manhattan, Kan.  
Swain, Geo. F., Mass. Inst. Technology, Cambridge, Mass.  
Toltz Engineering Co., 1410 Pioneer Bldg., St. Paul, Minn.  
Tuska, G. R., 68 William St., New York.

### COMBUSTION

Best, William Newton, 11 Broadway, New York.  
Cary, Albert A., 95 Liberty St., New York.  
Kuss, Robert H., Suite 805-112 W. Adam St., Chicago, Ill.

### COMPRESSED AIR MACHINERY

Dawley, C. A., 420 E. Sixth St., Plainfield, N. J.

### CONCRETE

Ancona, J. F., Cutler Bldg., Rochester, N. Y.  
Johnson, Nathan C., 149 Broadway, New York

### CONSTRUCTING

Arnold Co., 105 So. La Salle St., Chicago, Ill.  
Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.  
Kidde & Co., Inc., Walter, 140 Cedar St., New York.

Westcott and Mapes, Inc., New Haven, Conn.

### CONTRACTING

Bacon, Earle C., Havemeyer Bldg., New York.  
Bennett, Howard D., 2114 Allendale St., Baltimore, Md.  
Cummings, Wm. W., 15 Winter St., Woburn, Mass.  
Fillingham, Myles P., 50 Church St., New York.  
Livingston, Robert R., 2 Rector St., New York.  
Sinclair, A. P., 30 Church St., New York.  
Tappan, Charles O., 2 Rector St., New York.

### COSTS

Arison, Edgar E., 1535 Railway Exchange, Chicago, Ill.  
Kiddler, Walter M., 143 W. 82nd St., New York.  
Parsons Corp'n, G. K., 120 Broadway, New York.

Peirce, Jr., Edwin J., 253 Broadway, New York.

### CRANES, CABLE

Hays, Lewis T., 1054-4th Ave., S., Seattle, Wash.

## D

### DEHYDRATING

Colwell, James, V. V., 105 W. 40th St., New York.

### DESIGNING

Charter, James A., 1438 E. 65th Place, Chicago, Ill.  
Convery, John J., 19 W. 44th St., New York, N. Y.

App

Dawley, C. A., 420 E. Sixth St., Plainfield, N. J.  
 Gooding, Charles S., 27 School St., Boston, Mass.  
 Harris, Harry E., Bridgeport, Conn.  
 Sanborn, Frank E., Columbus, O.  
 Williams, H. J., 165 Broadway, New York.  
**DOCKS AND WAREHOUSES**  
 Toltz Engineering Co., 1410 Pioneer Bldg., St. Paul, Minn.  
**DRAINAGE AND RECLAMATION**  
 Elliott & Harman Engineering Co., 144 Fredonia Ave., Peoria, Ill.

E

**EFFICIENCY**

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 Coe, H. L., 79 Milk St., Boston, Mass.  
 Diemer, Hugo, State College, Pa.  
 Harpham, Barnes, Stevenson & Co., Inc., 79 Milk St., Boston, Mass.  
 Kidder, Walter M., 143 W. 82nd St., New York.  
 Shepard, George H., Navy Yard, Norfolk, Va.  
**ELECTRIC POWER SYSTEMS**  
 Thomas, Percy H., 120 Broadway, New York.

**ELECTRICAL**

Arnold Co., 105 So. La Salle St., Chicago, Ill.  
 Bibby, W. F., 112-10th Ave., N., Nashville, Tenn.  
 Colles, Geo. W., 301 Kress Bldg., Rosharon, Tex.  
 Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.  
 Fletcher-Thompson, Inc., 1089 Broad St., Bridgeport, Conn.  
 Frances, Isaac H., 1508 Commonwealth Trust Bldg., Philadelphia, Pa.  
 Gassman, Howard M., 706-707-708 Brown-Marx Bldg., Birmingham, Ala.  
 Gibbs, Geo., Pennsylvania Station, New York.  
 Grissinger, Elwood, 293 Lexington Ave., Buffalo, N. Y.  
 Hammer, Edwin W., 55 John St., New York.  
 Hatch, Edwin G., Equitable Bldg., New York.  
 Hopkins, Nevil Monroe, 2128 Bancroft Pl., Washington, D. C.  
 Jackson, D. C., and Wm. B., 248 Boylston St., Boston, Mass.  
 Jackson, Henry D., 88 Broad St., Boston, Mass.  
 Kidde & Co., Inc., Walter, 140 Cedar St., New York.  
 Lauder, George B., Concord, N. H.  
 Mershon, Ralph D., 80 Maiden Lane, New York.  
 Meyer, Jr., Henry C., and Jones, Bassett, Assoc., 101 Park Ave., New York.  
 Neiler, Rich & Co., 1409 Manhattan Bldg., Chicago, Ill.  
 Sessions, Frank L., Rockefeller Bldg., Cleveland, O.  
 Stone & Webster, 147 Milk St., Boston, Mass.  
 Thomas, Percy H., 120 Broadway, New York.  
 Toltz Engineering Co., 1410 Pioneer Bldg., St. Paul, Minn.  
 Vaughn & Meyer, 501-2 Security Bldg., Milwaukee, Wis.  
 Westcott and Mapes, Inc., New Haven, Conn.  
**ELECTROCHEMICAL**  
 Moulton Engineering Corp'n., 534 Congress St., Portland, Maine.

**ENGINE REGULATION**

Sargent, J. W., 303 Benefit St., Providence, R. I.  
**ENGINES, GAS**  
 Guthrie, James, Erie Bldg., Cleveland, O.  
**EXAMINATIONS AND REPORTS**  
 Carse, David B., 71 Broadway, New York.  
 Gilbreth, Inc., Frank B., 77 Brown St., Providence, R. I.

**—Central Stations**

Eager, William G., Valdosta, Georgia.

**EXCAVATING**

Massey Co., Geo. B., Peoples Gas Bldg., Chicago, Ill.

F

**FIRE PREVENTION**

Ancona, J. F., Cutler Bldg., Rochester, N. Y.

**FOUNDATIONS**

Moran, Daniel E., 55 Liberty St., New York.

**FOUNDRY PLANTS**

Lane Co., H. M., 58 Lafayette Blvd., Detroit, Mich.

**FURNACES, INDUSTRIAL**

Schwab, Gustav, 525 Market St., San Francisco, Cal.

G

**GAS**

Jackson, Lucian C., 905 D. S. Morgan Bldg., Buffalo, N. Y.  
 Lea, Henry I., 1352 Peoples Gas Bldg., Chicago, Ill.  
 Polk, Roger W., 193 Washington Ave., Providence, R. I.  
 Shiebler, Marvin, 80 Broadway, New York.

**GASOLINE RECOVERY**

Hope Engineering & Supply Co., Mt. Vernon, Ohio.

**GRAIN ELEVATORS**

Toltz Engineering Co., 1410 Pioneer Bldg., St. Paul, Minn.

H

**HEAT TREATING**

American Incandescent Heat Co., Inc., No. 10 Post Office Sq., Boston, Mass.  
 Schwab, Gustav, 525 Market St., San Francisco, Cal.

**HEATING**

Allen, William D., 951 Stuart Bldg., Seattle, Wash.  
 Ancona, J. F., Cutler Bldg., Rochester, N. Y.  
 Francis, Isaac H., 1508 Commonwealth Trust Bldg., Philadelphia, Pa.  
 Jellett Co., Stewart A., Real Estate Trust Bldg., Philadelphia, Pa.  
 MacLeod, Norman MacCallum, Station G., Germantown, Philadelphia, Pa.  
 McCann, Frank G., 500 Park Ave., New York.  
 Stevens, John A., 8 Merrimack St., Lowell, Mass.  
 Toltz Engineering Co., 1410 Pioneer Bldg., St. Paul, Minn.  
 Vaughn & Meyer, 501-2 Security Bldg., Milwaukee, Wis.  
 Woodwell, J. E., 8 W. 40th St., New York.

**—Hot Water, for Industrial Plants**

Allan, C. D., 230 S. La Salle St., Chicago, Ill.

**HIGHWAYS**

Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.

**HOISTING EQUIPMENT**

Horton, John T., 242 Bradhurst Ave., New York.

**HOTELS**

Place, Clyde R., 70 E. 45th St., New York.

**HYDRAULIC**

Carver, Fred S., 207 Market St., Newark, N. J.  
 Fuller & McClintock, 170 Broadway, New York.  
 Henry, Geo. J., 737 Rialto Bldg., San Francisco, Cal.  
 Hill & Ferguson, 100 William St., New York.  
 Kilpatrick, John D., 30 Church St., New York.  
 Moulton Engineering Corp'n., 534 Congress St., Portland, Maine.  
 Pollard, Seabury G., 3422 Burch Ave., Cincinnati, O.  
 Smith, Edward J., 30 Church St., New York.  
 Toltz Engineering Co., 1410 Pioneer Bldg., St. Paul, Minn.

I

**ILLUMINATING**

Vaughn & Meyer, 501-2 Security Bldg., Milwaukee, Wis.

**INDUSTRIAL**

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 Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.

Ind

**INDUSTRIAL (Continued)**

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 Guthrie Co., Wm. G. Flint, Mich.  
 Lewis, Warren B., 10 Weybosset St., Providence, R. I.  
 Moulton Engineering Corp'n, 534 Congress St., Portland, Maine  
 Parks & Son, Byron E., 509 Grand Rapids Savings Bank Bldg., Grand Rapids, Mich.  
 Slocum, Avram & Slocum, Inc., 531 W. 21st St., New York.  
 Vaughn & Meyer, 501-2 Security Bldg., Milwaukee, Wis.  
 Yeomans, Lucien I., Chicago, Ill.

**INDUSTRIAL PLANTS**

Cannon-Swenson Co., 53 W. Jackson Blvd., Chicago, Ill.  
 Main, Chas. T., 201 Devonshire St., Boston, Mass.  
 Place, Clyde R., 70 E. 45th St., New York.

**INSPECTION**

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 Conard, William R., Burlington, N. J.  
 Gulick-Henderson Co., 15 Park Row, New York.  
 Webster, William R., 411 Walnut St., Philadelphia, Pa.

**INVENTIONS****—Development**

Hopkins, Nevil Monroe, 2128 Bancroft Pl., Washington, D. C.

**L****LAYOUT****—Plant**

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**LIGHTING**

MacLeod, Norman MacCallum, Station G, MacLeods, Philadelphia, Pa.  
 Stevens, John A., 8 Merrimack St., Lowell, Mass.

**M****MANAGEMENT**

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 Carse, David B., 71 Broadway, New York.  
 Colwell, James V. V., 105 W. 40th St., New York.  
 Eager, William G., Valdosta, Georgia.  
 Gilbreth, Inc., Frank B., 77 Brown St., Providence, R. I.  
 Hall, Keppele, care Clinton Wire Cloth Co., Clinton, Mass.  
 Hannah, Frederick A., 40 Wall St., New York.  
 Kidder, Walter M., 143 W. 82nd St., New York.  
 Parsons Corp'n, G. K., 120 Broadway, New York.  
 Thompson & Lichtner, 136 Federal St., Boston, Mass.

**—Power Plants**

Eager, William G., Valdosta, Georgia.  
 Polakov, Walter N., 31 Nassau St., New York.

**—Public Utilities**

Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.

**MANUFACTURING METHODS**

Carver, Fred. S., 207 Market St., Newark, N. J.  
 Guthrie Co., Wm. G. Flint, Mich.  
 Harris, Harry E., Bridgeport, Conn.  
 Peirce, Jr., Edwin J., 253 Broadway, New York.

**MARINE**

Johnson, Eads, Rm. 614, 30 Church St., New York.  
 King, Frank B., 1442 Rhode Island Ave., N. W., Washington, D. C.

**MECHANICAL**

Adams, Henry, 1263-69 Calvert Bldg., Baltimore, Md.  
 Adamson, Cecil F., 318 Hamilton Bldg., Akron, O.  
 Addicks, Lawrence, 126 Liberty St., New York.  
 Alden, Frederick A., 60 Gorham St., Cambridge, Mass.  
 Allan, C. D., 230 S. La Salle St., Chicago, Ill.  
 Allen, Thomas H., 205 Bank of Commerce Bldg., Memphis, Tenn.  
 Allison, James E., 300 Security Bldg., St. Louis, Mo.  
 Almert, Harold, 209 S. La Salle St., Chicago, Ill.  
 Ammen, Francis D., 614 Bank of Commerce Bldg., St. Louis, Mo.  
 Ancona, John F., 224 Cutler Bldg., Rochester, N. Y.  
 Armstrong, Francis J., 149 Broadway, New York.  
 Arnold Co., 105 So. La Salle St., Chicago, Ill.  
 Arnott, Robert F., 165 Broadway, New York.  
 Austin, William A., 332 S. Michigan Ave., Chicago, Ill.  
 Austrom, Charles A., 44 W. 44th St., New York.  
 Bacon, John D., 1106 Am. Natl. Bank Bldg., San Diego, Cal.  
 Baehr, William A., Peoples Gas Bldg., Chicago, Ill.  
 Baldwin, Wm. J., 601 World Bldg., New York.  
 Barkley, Fred. W., 161 Devonshire St., Boston, Mass.  
 Barnaby, Chas. W., 257 Hamilton Ave., New Brighton, S. I., N. Y.  
 Barnes, William O., 770 Main St., Leominster, Mass.  
 Barrett, William F., 42nd St. Bldg., New York.  
 Bartlett, D. Dana, 44 W. 44th St., New York.  
 Bassinger, James G., 52 Broadway, New York.  
 Bates, James H. S., 85 Wall St., New York.  
 Baum, Frank G., 1901-1902 Hobart Bldg., San Francisco, Cal.  
 Bayley, Guy L., First Natl. Bank Bldg., San Francisco, Cal.  
 Bear, Oliver L., Laundryowners National Association, La Salle, Ill.  
 Behr, Hans C., 2 Rector St., New York.  
 Behrend, Bernard A., 200 Devonshire St., Boston, Mass.  
 Bell, John E., 111 Broadway, New York.  
 Bensel, John A., 111 Broadway, New York.  
 Berg, Christian P., 10 S. La Salle St., Chicago, Ill.  
 Berquist, John G., Brymptonwood, Glen Wood, L. L., N. Y.  
 Bigelow, Myron J., Amelia Apts., Park St., Akron, O.  
 Blatchley, Chas. A., 1052 Drexel Bldg., Philadelphia, Pa.  
 Bonine, Charles E., 609 Harrison Bldg., Philadelphia, Pa.  
 Borde, George U., 821 Hibernia Bldg., New Orleans, La.  
 Borge Incinerator Corp'n, 1216 Flatiron Bldg., New York.  
 Bowers, George W., 53 Devonshire St., Boston, Mass.  
 Boyd, John T., 231 Polifly Road, Hackensack, N. J.  
 Brett, Henry E., 114 N. Spring St., Los Angeles, Cal.  
 Brill, Geo. M., White Plains, New York.  
 Brinton, Willard C., 7 E. 42nd St., New York.  
 Broom, Benjamin A., 500 United Bank Bldg., Sioux City, Ia.  
 Brown, John W., Jr., 659 Calvert Bldg., Baltimore, Md.  
 Bulkeley, J. Norman, 120 Broadway, New York.  
 Bullard, Maurice L., 208 Granite St., Manchester, N. H.  
 Burr, William H., 120 Broadway, New York.  
 Bush, Harold M., 136 E. Gay St., Columbus, O.  
 Camp, Eugene V., Box 421, Atlanta, Ga.  
 Cannon-Swenson Co., 53 W. Jackson Blvd., Chicago, Ill.  
 Caracristi, V. Z., 30 Church St., New York.  
 Carbo, L. A., 1614 Eye St., N. W., Washington, D. C.

Ind

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 Case, Milo M., 116 S. Michigan Ave., Chicago, Ill.  
 Cathcart, William L., 636 Westview Ave., Germantown, Philadelphia, Pa.  
 Cattell, William A., Foxcroft Bldg., San Francisco, Cal.  
 Chamberlain, Paul M., 1719 Marquette Bldg., Chicago, Ill.  
 Church, Elihu C., 4 E. 130th St., New York.  
 Clyne, R. G., 700-704 Columbia Bldg., St. Louis, Mo.  
 Colby, Albert L., 447 Lehigh St., South Bethlehem, Pa.  
 Cole, Frank B., P. O. Box 563, Newnan, Ga.  
 Collins, Francis W., 50 Church St., New York.  
 Collins, Hubert E., 132 Boyce Ave., Utica, N. Y.  
 Colwell, James V. V., 105 W. 40th St., New York.  
 Comstock, Charles Worthington, 1005 First Natl. Bank Bldg., Denver, Colo.  
 Conant, Wm. S., 80 Griswold St., Detroit, Mich.  
 Cooper, Hugh L., 101 Park Ave., New York.  
 Cory, Harry T., 702 Nevada Bank Bldg., San Francisco, Cal.  
 Crawford, C. H., 112-10th Ave., N., Nashville, Tenn.  
 Crocker, Allen S., Mechanics Inst., Rochester, N. Y.  
 Curtis, Lewis E., Kenilworth, Ill.  
 Darlington, Wayne, Georgetown, S. C.  
 Dawley, C. A., 420 E. Sixth St., Plainfield, N. J.  
 Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.  
 Dempsey, Harry B., 26 Cortlandt St., New York.  
 Denny, Omer, 58 Sutter St., San Francisco, Cal.  
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 Dodge, Kern, Morris Bldg., Philadelphia, Pa.  
 Donnelly, William T., 17 Battery Place, New York.  
 Dorward, David, Jr., 503 Market St., San Francisco, Cal.  
 Douglas, Edwin R., Philadelphia, Pa.  
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 Ducas, Charles, 30 Church St., New York.  
 Dunham, George W., 868-874 Woodward Ave., Detroit, Mich.  
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 Eager, William G., Valdosta, Georgia.  
 Egbert, Charles C., 99 Gluck Bldg., Niagara Falls, N. Y.  
 Elrod, H. E., 505 Interurban Bldg., Dallas, Tex.  
 Ferguson, Hardy S., 200 Fifth Ave., New York.  
 Finkle, Frederick C., 448-449 I. W. Hellman Bldg., Los Angeles, Cal.  
 Firestone, Sigmund, Granite Bldg., Rochester, N. Y.  
 Fletcher-Thompson, Inc., 1089 Broad St., Bridgeport, Conn.  
 Ford, Bacon & Davis, 115 Broadway, New York.  
 Ford, Buck & Sheldon, Inc., Syracuse, N. Y.  
 Forstall, Alfred E., 15 Park Row, New York.  
 Fowler, Geo. L., 83 Fulton St., New York.  
 Francis, Isaac H., 1508 Commonwealth Trust Bldg., Philadelphia, Pa.  
 Francisco, Ferris L. R., 200 Fifth Ave., New York.  
 Franz, Walter G., Union Trust Bldg., Cincinnati, Ohio.  
 Freyn and Company, 643 Peoples Gas Bldg., Chicago, Ill.  
 Fuller, Floyd M., 813 Torrey Bldg., Duluth, Minn.  
 Funk, Nelson E., 31 Forest St., Montclair, N. J.  
 Gannon, Thomas J., 143 Liberty St., New York.  
 Gibson, Arthur, 1022 Haight St., San Francisco, Cal.  
 Gilbreth, Inc., Frank B., 77 Brown St., Providence, R. I.  
 Givan, Albert, 1525 K St., Sacramento, Cal.  
 Goldsborough, Winder E., 52 Vanderbilt Ave., New York.  
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 Gooding, Charles S., 27 School St., Boston, Mass.

Green Co., Samuel M., 293 Bridge St., Springfield, Mass.  
 Greist, A. O., 51 S. 42nd St., New York.  
 Griggs & Myers, 110 W. 40th St., New York.  
 Grossman, Albert, 112 Marlborough Rd., Brooklyn, N. Y.  
 Guthrie, James, 524 Erie Bldg., Cleveland, O.  
 Hall, Willis E., 68 William St., New York.  
 Hammond, John H., 71 Broadway, New York.  
 Hamner, Charles S., 165 Broadway, New York.  
 Hannah, Frederick A., 40 Wall St., New York.  
 Hanscom, William W., 848 Clayton St., San Francisco, Cal.  
 Hardesty, Frederick S., Riggs Bldg., Washington, D. C.  
 Hardy, George F., 309 Broadway, New York.  
 Harris, Harry E., Bridgeport, Conn.  
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 Hays, Lewis T., 1054 4th Ave., S., Seattle, Wash.  
 Hayward, H. W., Mass. Institute of Technology, Cambridge, Mass.  
 Henderson, George R., 1321 Walnut St., Philadelphia, Pa.  
 Henshaw, Frederic V., 25 Nassau St., New York.  
 Herrick Carl A., 2816 Thomas Ave., S., Minneapolis, Minn.  
 Hessenbruch, George S., 919-920 Victoria Bldg., St. Louis, Mo.  
 Hickman, Charles D., 1414 S. Penn Sq., Philadelphia, Pa.  
 Hill, E. R., Pennsylvania Station, New York.  
 Hirsch, Gustav, 274 S. 3rd St., Columbus, O.  
 Hope Engineering & Supply Co., Mt. Vernon, O.  
 Hopkins, Nevil Monroe, 2128 Bancroft Pl., Washington, D. C.  
 Hopps, John H., 503 Market St., San Francisco, Cal.  
 Hornung, Geo., Woolsack Bldg., Newport, Ky.  
 Horton, John T., 242 Bradhurst Ave., New York.  
 Howe, Albert W., Hotel St. George, Brooklyn, N. Y.  
 Hugo, T. W., 221 W. 6th Ave., Duluth, Minn.  
 Hunt, Andrew M., 55 Liberty St., New York.  
 Hutton, Sol. E., 115 Van Buren St., Moscow, Idaho.  
 Jackson, Francis W., 20 Dufferin St., Kingston, Ont., Canada.  
 Johnson, Warren, 122 Carondelet St., New Orleans, La.  
 Keilholtz, Pierre O., Continental Bldg., Baltimore, Md.  
 Kellogg, Alfred S., Boston, Mass.  
 Kelly, Thos. C., 405 2nd Natl. Bank Bldg., Cincinnati, O.  
 Kennedy, J. J., 52 Broadway, New York.  
 Kennedy, William P., 1790 Broadway, New York.  
 Kent, Robert T., 432 Fourth Ave., New York.  
 Kidd, Andrew, Jr., 95 Liberty St., New York.  
 Kidde & Co., Inc., Walter, 140 Cedar St., New York.  
 Kidder, Walter M., 143 W. 82nd St., New York.  
 Kimball Co., Richard D., 6 Beacon St., Boston, Mass.  
 Kingsburg, Albert, 945 Oliver Bldg., Pittsburgh, Pa.  
 Knox, S. L. Griswold, 544 Market St., San Francisco, Cal.  
 Kramer, Xavier A., Magnolia, Miss.  
 Kroto, George, 320 E. Hudson Terminal Bldg., New York.  
 Krummel, Louis C., 488 Nostrand Ave., Brooklyn, N. Y.  
 Kuss, Robert H., Suite 805-112 W. Adams St., Chicago, Ill.  
 Lacombe, Charles F., 45 Broadway, New York.  
 Ladd, Jas. B., 1011 Chestnut St., Philadelphia, Pa.  
 Lamont, Clarence B., Hoge Bldg., Seattle, Wash.  
 Lea, Edward S., 229 Chestnut Ave., Trenton, N. J.  
 Leland & Huley, 434 Holbrook Bldg., San Francisco, Cal.  
 Leoni, A. M., P. O. Box 574, Dayton, Ohio.  
 Lewis, Clifford J., 526 Meridian Life Bldg., Indianapolis, Ind.

Mec

**MECHANICAL (Continued)**

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 Lewis, Joseph E., 1218 Warner St., Baltimore, Md.  
 Lewis, Warren B., 10 Weybosset St., Providence, R. I.  
 Lichtner, Wm. O., 136 Federal St., Boston, Mass.  
 Lide, Martin J., Woodward Bldg., Birmingham, Ala.  
 Lockwood, J. B. C., 508 Worcester Bldg., Portland, Ore.  
 Loomis, Evarts G., 678 Highland Ave., Newark, N. J.  
 Loss, Henrik V., North Am. Bldg., Philadelphia, Pa.  
 Lovell, Alfred, 619 Harrison Bldg., Philadelphia, Pa.  
 McAllister, Addams S., 261 W. 23rd St., New York.  
 MacLeod, Norman MacCallum, Station G, Germantown, Philadelphia, Pa.  
 Main, Chas. T., 201 Devonshire St., Boston, Mass.  
 Manning, Charles B., 886 Elm St., Manchester, N. H.  
 Manning, Chas. H., 886 Elm St., Manchester, N. H.  
 Marks, Lionel S., Mass. Institute of Technology, Cambridge, Mass.  
 Massey Co., Geo. B., Peoples Gas Bldg., Chicago, Ill.  
 Maury, Dabney H., 1137 Monadnock Block, Chicago, Ill.  
 Maytham, Walter J., 2123 Cleveland Ave., N. W., Canton, O.  
 Meaker, Guy L., 311 Campbell St., Joliet, Ill.  
 Mees, Curtis A., 310 Trust Bldg., Charlotte, N. C.  
 Merrick, Dwight V., 34 Grammercy Park, New York.  
 Meyer, Jr., Henry C., and Jones, Bassett, Assoc., 101 Park Ave., New York.  
 Middleton, Harvey, Thurmont, Md.  
 Mills, Charles, 23 High St., Newton Upper Falls, Mass.  
 Mole, Harvey E., 55 Liberty St., New York.  
 Monaghan, James F., 79 Milk St., Boston, Mass.  
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 Moore, Frederick C., 710 Engineers Bldg., Cleveland, O.  
 Morrin & Coddington, 547 Phelan Bldg., San Francisco, Cal.  
 Moses, Lucius L., 1715 Harvard Ave., Seattle, Wash.  
 Moulton Engineering Corp'n, 534 Congress St., Portland, Maine.  
 Nedden, F. zur, 24 N. Moore St., New York.  
 Neiler, Rich & Co., 1409 Manhattan Bldg., Chicago, Ill.  
 Norden, Carl L., 375 Fulton St., Brooklyn, N. Y.  
 Norris, Robert V., 520-524 Second Natl. Bank Bldg., Wilkes-Barre, Pa.  
 Norton, Fred. E., 656 Main St., Worcester, Mass.  
 Nygren, Werner, 101 Park Ave., New York.  
 Oatman, Paul B., 2 Rector St., New York.  
 Otis, Robt. B., Stroh Bldg., Milwaukee, Wis.  
 Parks & Son, Byron E., 509 Grand Rapids Savings Bank Bldg., Grand Rapids, Mich.  
 Parsons Corp'n, G. K., 120 Broadway, New York.  
 Pattison, Frank A., 1182 Broadway, New York.  
 Pinger, George C., 52 Vanderbilt Ave., New York.  
 Placer, Clyde R., 70 E. 45th St., New York.  
 Polakov, Walter N., 31 Nassau St., New York.  
 Polson, Joseph A., East Lansing, Mich.  
 Porter, George, Box 327, Uniontown, Fayette Co., Pa.  
 Posey, James, 925 Fidelity Bldg., Baltimore, Md.  
 Price, Albert M., 617 W. Jackson Blvd., Chicago, Ill.  
 Proutt, Frederick G., 374 Randolph Bldg., Memphis, Tenn.  
 Quick, Howard P., 165 Broadway, New York.  
 Ramsey, George, 4700-Floor, Woolworth Bldg., New York.

**Mec**

Ransom, T. W., 1104 Merchants Exch. Bldg., San Francisco, Cal.  
 Reeder, Charles L., Park Ave. & Saratoga St., Baltimore, Md.  
 Reeve, Sidney A., 120 Broadway, New York.  
 Rice, Arthur L., 537 So. Dearborn St., Chicago, Ill.  
 Rice, Calvin W., 29 W. 39th St., New York.  
 Richmond, Knight C., 10 Weybosset St., Providence, R. I.  
 Rider, Joseph B., 29 Broadway, New York.  
 Ripley, W. H., 6 Beekman St., New York.  
 Rippey, Howard S., 7012 Greene St., Germantown, Philadelphia, Pa.  
 Rockwell, W. F., 1786 E. 89th St., Cleveland, O.  
 Roelker, Carl J., State Bank Bldg., Richmond, Va.  
 Roney, William R., 149 Broadway, New York.  
 Rose, F. W., Auditorium Bldg., Minneapolis, Minn.  
 Ross, Charles E., 52 Beaver St., New York.  
 Rucker, B. Parks, Garrett Park, Md.  
 Runyon, Frederick O., 845 Broad St., Newark, N. J.  
 Sahmel, Viggo, 50 Church St., New York.  
 Sanborn, Frank E., Columbus, O.  
 Sargent, J. W., 303 Benefit St., Providence, R. I.  
 Sawtelle, Edmund M., 5 Beekman St., New York.  
 Scarfe, George E., P. O. Box 655, Nevada City, Cal.  
 Schaupp, Charles E., 304 Commonwealth Trust Bldg., Harrisburg, Pa.  
 Schloss, Newton L., 25 W. 32nd St., New York.  
 Schoenijahn, Robert P., Church Bldg., Wilmington, Del.  
 Schwab, Gustav, 525 Market St., San Francisco, Cal.  
 Scrivenor, Arthur, Allison Bldg., Richmond, Va.  
 Sederholm, E. T., 495 Jefferson St., Pomona, Cal.  
 Sessions, Edson O., 5022 Sheridan Road, Chicago, Ill.  
 Sessions, Frank L., Rockefeller Bldg., Cleveland, O.  
 Sheldon & Son, F. P., 603 Industrial Trust Bldg., Providence, R. I.  
 Shiebler, Marvin, 80 Broadway, New York.  
 Simmons, Herman R., Box 446, Peace Dale, R. I.  
 Sinclair, George M., 618 Chestnut St., Philadelphia, Pa.  
 Skogmark, John, 35 Nassau St., New York, N. Y.  
 Smith, Jesse M., 194 Riverside Drive, New York.  
 Snow, Sylvester M., 55 Kilby St., Boston, Mass.  
 Soper, Ellis Clarke, St. Elmo, Tenn.  
 Spilsbury, Edmund G., 45 Broadway, New York.  
 Stephens, Pinchas V., 1258 Morris Ave., New York.  
 Stevens, John A., 8 Merrimack St., Lowell, Mass.  
 Stone & Webster, 147 Milk St., Boston, Mass.  
 Straub, Albert A., 1110 Peoples Bank Bldg., Pittsburgh, Pa.  
 Stringham, Joseph S., 1860 Penobscot Bldg., Detroit, Mich.  
 Stucki, A., Oliver Bldg., Pittsburgh, Pa.  
 Sutton, Frank, 80 Broadway, New York.  
 Taylor, Percy B., Essex Bldg., Newark, N. J.  
 Thomson, Samuel G., 120 Broadway, New York.  
 Thomson, T. Kennard, 50 Church St., New York.  
 Tolts Engineering Co., 1410 Pioneer Bldg., St. Paul, Minn.  
 Tomlins, Thomas L., Flower Bldg., Watertown, N. Y.  
 Tompkins, Stonewall, Room 720, 111 Broadway, New York.  
 Tyng, Arthur, 45 Church St., Buffalo, N. Y.  
 Unger, John S., 3344 Broadway, Chicago, Ill.  
 Van Duzee, Harold, 427 Walnut St., Philadelphia, Pa.  
 Varney, William M., 1221 Calvert Bldg., Baltimore, Md.  
 Vaughn & Meyer, 501-2 Security Bldg., Milwaukee, Wis.  
 Vickess, Samuel, 129 Front St., New York.  
 Waddell, Charles E., 78 Patton Ave., Asheville, N. C.  
 Wait, Henry H., Waverly & St. Joe Roads, Chestertown, Ind.



Waite, Edward B., Worcester, Mass.  
 Warren, Kenneth L., Fraserville, Que., Canada.  
 Wayte, Inc., W. J., 1 Liberty St., New York.  
 Westcott and Mapes, Inc., New Haven, Conn.  
 Whitam, Jay M., 607 Bullitt Bldg., Philadelphia, Pa.  
 Whiting, Charles W., 148 State St., Cambridge, Mass.  
 Wieland, Chas. F., 1803 Claus Spreckels Bldg., San Francisco, Cal.  
 Wilbur, Ralston T., P. O. Box 566, Spokane, Wash.  
 Wilkinson, Thomas L., 407-406 Boston Bldg., Denver Colo.  
 Willcox Engineering Co., 1520 Holland Ave., Saginaw, Mich.  
 Willette, Charles W., Lock Box 156, Seattle, Wash.  
 Williams, H. J., 165 Broadway, New York.  
 Wolcott, Henry A., West Hartford, Conn.  
 Wood, Albert C., Philadelphia Stock Exch. Bldg., Philadelphia, Pa.  
 Woodwell, J. E., 8 W. 40th St., New York.  
 Wyr, Samuel S., Harrison Bldg., Columbus, O.  
 Yates, Preston K., 120 Broadway, New York.  
 Yeomans, Lucien I., Chicago, Ill.  
 Young, G. A., Purdue University, Lafayette, Ind.

**METALLURGICAL**  
 Herron, James H., 2041 E. 3rd St., Cleveland, O.  
 Hollis, Henry L., 1025 Peoples Gas Bldg., Chicago, Ill.  
 Johnson, J. E., Jr., 52 Williams St., New York.

**MILL**  
 Ancona, John F., 224 Cutler Bldg., Rochester, N. Y.  
 Fletcher-Thompson, Inc., 1089 Broad St., Bridgeport, Conn.  
 Makepeace, C. R., Butler Exch. Bldg., Providence, R. I.

# MINES

—**Electrical Equipment**  
 Sessions, Frank L., Rockefeller Bldg., Cleveland, O.  
 —**Power Requirements**  
 Sessions, Frank L., Rockefeller Bldg., Cleveland, O.

# MINING MACHINERY

Hatch, Edwin G., Equitable Bldg., New York.

# MODELS

Monte, Robert Alva, 127 W. Westfield Ave., Roselle Park, N. J.

# MOTION STUDY

Gilbreth, Inc., Frank B., 77 Brown St., Providence, R. I.

# MOTIVE POWER

Austin, William A., 555 McCormick Bldg., Chicago, Ill.

# MUNICIPAL

Toltz Engineering Co., 1410 Pioneer Bldg., St. Paul, Minn.

# N

# NATURAL GAS PLANTS

Hope Engineering & Supply Co., Mt. Vernon, O.

# O

# ORGANIZATION

Arison, Edgar E., 1535 Railway Exchange, Chicago, Ill.  
 Boyd, John T., 231 Polify Road, Hackensack, N. J.  
 Carse, David B., 71 Broadway, New York.  
 Hannah, Frederick A., 40 Wall St., New York.  
 Hubbard and Harris, P. O. Box 1008, Bridgeport, Conn.  
 Kidder, Walter M., 143 W. 82nd St., New York.  
 Thompson & Lichtner, 136 Federal St., Boston, Mass.

# P

# PAPER MILLS

Orbison, Thomas W., Appleton, Wis.

# PATENTS

Van Winkle, Edward, 90 West St., New York.

# —Attorneys at Law

Ammen, Francis D., 614 Bank of Commerce Bldg., St. Louis, Mo.  
 Gooding, Charles S., 27 School St., Boston, Mass.  
 Ramsey, George, 4700-Floor, Woolworth Bldg., New York.  
 Varney, William W., 1221 Calvert Bldg., Baltimore, Md.

# —Development

Matthews, F. E., 35 Runyon St., Newark, N. J.

# —Electrical Expert

Sessions, Frank L., Rockefeller Bldg., Cleveland, O.

# —Mechanical Expert

Sessions, Frank L., Rockefeller Bldg., Cleveland, O.

# PLUMBING

MacLeod, Norman MacCallum, Station G., Germantown, Philadelphia, Pa.

# POTASH PLANTS

Cannon-Swenson Co., 53 W. Jackson Blvd., Chicago, Ill.

# POWER GENERATION

Allan, C. D., 230 S. La Salle St., Chicago, Ill.  
 Bullard, Maurice L., 208 Granite St., Manchester, N. H.  
 Carse, David B., 71 Broadway, New York.  
 Dreyfus, Edwin D., 14 N. High St., Columbus, O.  
 Francis, Isaac H., 1508 Commonwealth Trust Bldg., Philadelphia, Pa.  
 Marks, Lionel S., Mass. Institute of Technology, Cambridge, Mass.  
 Sargent, J. W., 303 Benefit St., Providence, R. I.  
 Williams, H. J., 165 Broadway, New York.

# POWER PLANTS

Cary, Albert A., 95 Liberty St., New York.  
 Collins, Hubert E., 132 Boyce Ave., Utica, N. Y.  
 Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.  
 Griggs & Myers, 110 W. 40th St., New York.  
 Jellett Co., Stewart A., Real Estate Trust Bldg., Philadelphia, Pa.  
 Meyer, Jr., Henry C., and Jones, Bassett, Assoc., 101 Park Ave., New York.  
 Norton, Fred E., 656 Main St., Worcester, Mass.  
 Stevens, John A., 8 Merrimack St., Lowell, Mass.  
 Stone & Webster, 147 Milk St., Boston, Mass.  
 Toltz Engineering Co., 1410 Pioneer Bldg., St. Paul, Minn.

# —Construction

Collins, Hubert E., 132 Boyce Ave., Utica, N. Y.  
 Norton, Fred E., 656 Main St., Worcester, Mass.  
 Stevens, John A., 8 Merrimack St., Lowell, Mass.

# —Hydro-Electric

Main, Chas. T., 201 Devonshire St., Boston, Mass.  
 Orbison, Thomas W., Appleton, Wis.  
 Power Engineering Co., Minneapolis, Minn.

# —Mine

Hatch, Edwin G., Equitable Bldg., New York.

# —Operation

Collins, Hubert E., 132 Boyce Ave., Utica, N. Y.  
 Norton, Fred E., 656 Main St., Worcester, Mass.

# POWER TRANSMISSION

Thomas, Percy H., 120 Broadway, New York.

# —High Tension

Hatch, Edwin G., Equitable Bldg., New York.

# PRODUCTION

Arison, Edgar E., 1535 Railway Exchange, Chicago, Ill.  
 Ayres, R. S., 10 Wellman St., Brookline, Mass.  
 Kidder, Walter M., 143 W. 82nd St., New York.  
 Lewis, Warren B., 10 Weybosset St., Providence, R. I.  
 Parsons Corp'n, G. K., 120 Broadway, New York.

Pro

**PRODUCTION (Continued)**

Pearce, Jr., Edwin J., 253 Broadway, New York.

**PROJECTILES**

Healy, Frederick E., 1387 Queen St., W., Toronto, Ont., Can.

**PUBLIC UTILITIES**

Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.

Jackson, D. C. & Wm. B., Harris Trust Bldg., Chicago, Ill.

Stone & Webster, 147 Milk St., Boston, Mass.

**PUBLICITY, TECHNICAL**

Horton, Charles M., 575 W. 187th St., New York.

**PULP AND PAPER**

Moulton Engineering Corp'n, 534 Congress St., Portland, Maine.

**R**

**RAILROAD STATIONS**

Place, Clyde R., 70 E. 45th St., New York.

**RAILWAY EQUIPMENT**

Austin, William A., 555 McCormick Bldg., Chicago, Ill.

**RATE SETTING**

Hubbard and Harris, P. O. Box 1008, Bridgeport, Conn.

**REFRIGERATION**

Matthews, P. E., 35 Runyon St., Newark, N. J.  
Rantz, Charles F., 4116-4126 Carrollton Ave., New Orleans, La.

**RESEARCH**

Clyne, R. G., 700-704 Columbia Bldg., St. Louis, Mo.

**S**

**SALT WORKS**

Willcox Engineering Co., 1520 Holland Ave., Saginaw, Mich.

**SANITARY**

Francis, Isaac H., 1508 Commonwealth Trust Bldg., Philadelphia, Pa.

Gerhard, Wm. Paul, Room 826, 30 E. 42nd St., New York.

Hering, Rudolph, 170 Broadway, New York.

Hill & Ferguson, 100 William St., New York.

**SHIPBUILDING OVERHEAD SYSTEMS**

Hays, Lewis T., 1054 4th Ave., S., Seattle, Wash.

**STEAM PLANTS**

Kuss, Robert H., Suite 805 112 W. Adam St., Chicago, Ill.

Main, Chas. T., 201 Devonshire St., Boston, Mass.

Woodwell, J. E., 8 W. 40th St., New York.

**STOCK SYSTEMS**

Hubbard and Harris, P. O. Box 1008, Bridgeport, Conn.

**SUGAR FACTORIES**

Cannon-Ewenson Co., 53 W. Jackson Blvd., Chicago, Ill.

Dyer Co., 2031 Euclid Ave., Cleveland, O.  
Vickess, Samuel, 129 Front St., New York.

**SUPERVISION**

Boyd, John T., 231 Polify Rd., Hackensack, N. J.

**—Power Plant**

Woodwell, J. E., 8 W. 40th St., New York.

**T**

**TANNERIES**

Parks & Son, Byron E., 509 Grand Rapids Savings Bank Bldg., Grand Rapids, Mich.

**TESTS**

**—Plant**

Williams, H. J., 165 Broadway, New York.

**—Power**

Cary, Albert A., 95 Liberty St., New York.

Polakov, Walter N., 31 Nassau St., New York.

Williams, H. J., 165 Broadway, New York.

**TEXTILE MILLS**

Main, Chas. T., 201 Devonshire St., Boston, Mass.

**TRADEMARKS**

Varney, William W., 1221 Calvert Bldg., Baltimore, Md.

**TRAMWAYS, WIRE ROPE**

Hays, Lewis T., 1054 4th Ave., S., Seattle, Wash.

**V**

**VENTILATING**

Allan, C. D., 230 S. La Salle St., Chicago, Ill.

Ancona, J. F., Cutler Bldg., Rochester, N. Y.

Francis, Isaac H., 1508 Commonwealth Trust Bldg., Philadelphia, Pa.

Jellett Co., Stewart A., Real Estate Trust Bldg., Philadelphia, Pa.

MacLeod, Norman MacCallum, Station G., Germantown, Philadelphia, Pa.

McCann, Frank G., 500 Park Ave., New York.

Toltz Engineering Co., 1410 Pioneer Bldg., St. Paul, Minn.

Vaughn & Meyer, 501-2 Security Bldg., Milwaukee, Wis.

Woodwell, J. E., 8 W. 40th St., New York.

**W**

**WASTE UTILIZATION**

Wayte, Inc., W. H., 1 Liberty St., New York.

**WATER PURIFICATION**

Rice, Cyrus Wm., 826 Bulletin Bldg., Philadelphia, Pa.

**WORK ROUTING**

Hubbard and Harris, P. O. Box 1008, Bridgeport, Conn.

Pro

**DIRECTORY SECTION**  
**PART II**

**Mechanical Equipment**  
**Directory**

481

**I**N this, its second issue as a reference feature of the volume of Condensed Catalogues, the general Mechanical Equipment Directory shows a considerable gain in scope and comprehensiveness, as compared with its initial appearance in the 1916 volume.

Wherever the omission of appropriate subject headings has been noted in this office, or called to the attention of the Society by members or others, these have been added. At the same time every effort has been made to secure and include the names of the greatest possible number of eligible manufacturers, with the result that in this volume the Directory contains the names and addresses of more than 3200 firms, listed under upward of 2500 classifications of equipment.

Owing to the considerable extra cost of compiling and publishing the Directory, it was found necessary, as in the previous issue, to limit the free listings for non-space users to three subject headings for each firm, additional listings being procurable at the rate of three dollars each. Firms using space for publication of their data in the Catalogue Section of the volume are entitled to full listing of their products in the Directory without additional charge, with firm name printed in capital type and followed by the page numbers of their catalogue data.

Continuing the policy established last year, a verification in the form of a statement covering the items of its manufacture was required from each firm. Such omissions as may be noted in the Directory are due in most cases to failure on the part of the firms in question to furnish the verification requested.

The Mechanical Equipment Directory is especially designed to meet the ready-reference needs of mechanical engineers and others requiring a highly specialized list of this description. It is believed that in its improved form the Directory will prove invaluable for this purpose, and also as a guide to and background for the more detailed information presented in the Catalogue Section of the volume.

# MECHANICAL EQUIPMENT DIRECTORY

## A

### ABRASIVE MATERIALS

Abrasive Co., Bridesburg, Philadelphia, Pa.  
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Dessau, Maurice, 6 Maiden Lane, New York  
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### ACCUMULATORS, HYDRAULIC

Aldrich Pump Co., Allentown, Pa.  
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Carver, Fred S., 207 Market St., Newark, N. J.  
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NILES-BEMENT-POND CO., 111 Broadway,  
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Perrin & Co., Wm. R., 37 W. Van Buren St.,  
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SOUTHWARK FOUNDRY & MACHINE CO.,  
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### ACETYLENE APPARATUS

Carbic Mfg. Co., Duluth, Minn.  
Modern Engineering Co., 14th & St. Charles  
Sts., St. Louis, Mo.

OKWELD ACETYLENE CO., 646-686 Freling-  
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### ACETYLENE GAS

Air Reduction Sales Co., 120 Broadway, New  
York  
Prest-O-Lite Co., Inc., Speedway, Indianapolis,  
Ind.

### ACETYLENE LIGHTS (Portable)

Milburn Co., Alexander, Baltimore, Md.

### AERIAL TRAMWAYS

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### AGITATORS

\*DE LA VERGNE MACHINE CO., 1123 E.  
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PFAUDLER CO., Rochester, N. Y... p. 384

Sowers Mfg. Co., 1300 Niagara St., Buffalo, N. Y.

### AGRICULTURAL MACHINERY

Ann Arbor Machine Co., Ann Arbor, Mich.  
Associated Mfg. Co., Waterloo, Ia.

Case Threshing Machine Co., J. I., Racine,  
Wis.

Castle Engineering Co., Inc., A. M., La Crosse,  
Wis.

Fairmont Gas Engine & Railway Motor Car  
Co., North Main St., Fairmont, Minn.

Gale Mfg. Co., Albion, Mich.

Holt Mfg. Co., Peoria, Ill.

International Harvester Co. of America, Har-  
vester Bldg., Chicago, Ill.

Russell & Co., Massillon, O.

### AIR BRAKES, COMPRESSORS, SEPARATORS, ETC.

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Air)

### AIR CONDITIONING APPARATUS

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Carrier Air Conditioning Co., Buffalo, N. Y.

Carrier Engineering Corp'n, 39 Cortlandt St.,  
New York

Cramer, Stuart W., Charlotte, N. C.

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New York... p. 366

Drying Systems, Inc., 910 S. Michigan Ave.,  
Chicago, Ill.

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Jacobson & Sons Co., I. M., Detroit, Mich.  
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BROWN INSTRUMENT CO., Philadelphia, Pa... p. 416

\*GENERAL ELECTRIC CO., Schenectady, N. Y... pp. 20, 21, 406

Jewell Electrical Instrument Co., 810 W. Lake St., Chicago, Ill.

Pignolet, Louis M., 78 Cortlandt St., New York Republic Flow Meters Co., 565 Washington Blvd., Chicago, Ill.

\*WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa... pp. 96, 97

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Hert & Frerichs Chemical Co., 929 Pierce Bldg., St. Louis, Mo.

National Ammonia Co., St. Louis, Mo.

**—Aqua**

Hert & Frerichs Chemical Co., 929 Pierce Bldg., St. Louis, Mo.

National Ammonia Co., St. Louis, Mo.

**AMMONIA CONDENSERS, FITTINGS, ETC.**

(See Condensers, Fittings, etc., Ammonia)

**AMMONIA SAFETY SYSTEMS**

Henneböhle Co., F., 81st St. & S. Chicago Ave., S. Chicago, Ill.

**ANCHORS, EXPANSION**

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Steward & Romaine Mfg. Co., 124 N. 6th St., Philadelphia, Pa.

**ANEMOMETERS**

Davis Instrument Mfg. Co., Inc., 110 W. Fayette St., Baltimore, Md.

Queen-Gray Co., 616-620 Chestnut St., Philadelphia, Pa.

\*TAYLOR INSTRUMENT COS., Rochester, N. Y... p. 419

**ANNEALING**

\*AMERICAN METAL TREATMENT CO., Elizabeth, N. J... p. 332

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**ARBORS**

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**ARCHES****—Boiler**

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Phable Fire Brick Co., 133 W. Washington St., Chicago, Ill.

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Monarch Boiler Arch Co., 629-630 Wells Bldg., Milwaukee, Wis.

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**—Ignition (Flat, Suspended)**

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Factory Engineering Co., 707 Electric Bldg., Cleveland, O.

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Factory Engineering Co., 707 Electric Bldg., Cleveland, O.

\*GREEN ENGINEERING CO., East Chicago, Ind... pp. 70, 71

McLeod & Henry Co., Troy, N. Y.

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**—Sectional (Locomotive)**

American Arch Co., McCormick Bldg., Chicago, Ill.

**ASBESTOS PRODUCTS**

Acme Asbestos Covering & Supply Co., 401 N. Ada St., Chicago, Ill.

Asbestos & Rubber Works of America, 1784 Broadway, New York

Burgman Asbestos & Packing Mills, Feodor, 26 Cortlandt St., New York

Carey Co., Philip, Cincinnati, O.

Central Asbestos & Magnesite Co., 214-216 W. Grand Ave., Chicago, Ill.

Fibre Cell Asbestos Mfg. Co., 407-409 S. Clinton St., Chicago, Ill.

Franklin Mfg. Co., Franklin, Pa.

General Asbestos & Rubber Co., Charleston, S. C.

\*GREENE, TWEED & CO., 109 Duane St., New York... p. 140

\*JOHNS-MANVILLE CO., H. W., 296 Madison Ave., New York... p. 133

Keasbey Co., Robert A., 445 West St., New York

Keasbey & Mattison Co., Ambler, Pa.

Advertisements of firms marked \* appear in The Journal, A. S. M. E.

\*MAGNESIA ASSOCIATION OF AMERICA,  
702 Bulletin Bldg., Philadelphia, Pa... *p. 134*  
Nightingale & Childs Co., 205 Congress St.,  
Boston, Mass.  
Norristown Magnesia & Asbestos Co., Norristown,  
Pa.  
Richards Mfg. Co., 325 Scriben Ave., Grand  
Rapids, Mich.  
Sall Mountain Co., 230 S. La Salle St., Chicago,  
Ill.  
Thermoid Rubber Co., Trenton, N. J.

**ASH HANDLING SYSTEMS (Steam Jet)**

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Quickwork Co., St. Marys, O.

**AUTOMOBILE PARTS**

Babson-Dow Mfg. Co., 60 Fulda St., Roxbury,  
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Chicago Screw Co., 1026 S. Homan Ave., Chicago,  
Ill.

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Clark Equipment Co., 1415 Railway Exchange,  
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Empire Axle Co., Dunkirk, N. Y.  
Hess Spring & Axle Co., 124 W. 66th St., Car-  
thage, Cincinnati, O.

Industrial Equipment Co., 70th & Garfield Ave.,  
Oakland, Cal.

Jacobson Machine Mfg. Co., Warren, Pa.  
Sabin Machine Co., Cleveland, O.

Sheldon Axle & Spring Co., Wilkes-Barre, Pa.  
Spacke Machine & Tool Co., Indianapolis, Ind.

Standard Parts Co., Cleveland, O.  
Timken Roller Bearing Co., 136 Clark Ave.,  
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Eastwood Wire Mfg. Co., Belleville, N. J.

Empire Metal Co., Syracuse, N. Y.  
Frictionless Metal Co., 1103 Chestnut St.,  
Chattanooga, Tenn.

Jacobson & Sons Co., I. M., Detroit, Mich.  
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Marx & Sons, A., 1645 Tchoupitoulas St., New  
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Murdoch & Co., H., 432 Wood St., Pittsburgh,  
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Murphy Metals Co., 818 Webster Bldg., Chicago,  
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Muzzy-Lyon Co., Detroit, Mich.  
Pacific Metal Works, 153 First St., San Fran-  
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Central Scientific Co., 460 E. Ohio St., Chicago, Ill.

Standard Scientific Co., 147-153 Waverly Place, New York  
Torsion Balance Co., 92 Reade St., New York

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Pittsburgh Forge & Iron Co., 1003 Penn Ave., Pittsburgh, Pa.  
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St. Louis Screw Co., St. Louis, Mo.

**BAR STEEL**

Carbon Steel Co., P. O. Box 1591, Pittsburgh, Pa.  
Illinois Steel Co., 208 S. La Salle St., Chicago, Ill.  
Lockhart Iron & Steel Co., Pittsburgh, Pa.  
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U. S. Light & Heat Corp'n, Niagara Falls, N. Y.

Waterbury Battery Co., Waterbury, Conn.  
Willard Storage Battery Co., Cleveland, O.  
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##### —Babbitt (Die Cast)

Alloy Die Casting Co., 80 E. Fort St., Detroit, Mich.

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"Indians" Die Casting Co., 1016 E. 11th St., Indianapolis, Ind.

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Bearings Co. of America, Lancaster, Pa.

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Fafnir Bearing Co., New Britain, Conn.

Federal Bearings Co., Inc., 110 William St., Poughkeepsie, N. Y.

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\*HILL CLUTCH CO., Cleveland, O. *p. 170*  
HOGGSON & PETTIS MFG. CO., New Haven, Conn. *pp. 310, 311, 312*

\*LEHIGH CAR, WHEEL & AXLE WORKS, Catsaqua, Pa. *p. 76*

\*LINK-BELT CO., 39th St. & Stewart Ave., Chicago, Ill. *p. 207*

Munson Mill Machinery Co., Inc., 405 Broadway, Utica, N. Y.

Smidth & Co., F. L., 50 Church St., New York  
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\*WOOD'S SONS CO., T. B., Chambersburg, Pa. *pp. 172, 173*

# **BELTING**

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RHOADS & SONS, J. E., 12 N. Third St., Philadelphia, Pa. *pp. 194, 195*  
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## **—Balata**

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Dick, Ltd., R. & J., Passaic, N. J.  
Manheim Mfg. & Belting Co., Manheim, Pa.

Republic Rubber Co., Youngstown, O.  
Victor Balata & Textile Belting Co., 38 Murray St., New York

## **—Canvas**

Acme Belting Co., Niles, Mich.  
Burrell Belting Co., 413-417 S. Hermitage Ave., Chicago, Ill.

Chesapeake Belting Co., Baltimore, Md.  
Dick, Ltd., R. & J., Passaic, N. J.

Hettrick Mfg. Co., Toledo, O.  
Imperial Belting Co., 400 N. Kinzie St., Chicago, Ill.

Johnson Belting Co., 342 E. 38th St., New York  
Main Belting Co., 1217-1241 Carpenter St., Philadelphia, Pa.

Nott Co., W. S., 201-211 N. Third St., Minneapolis, Minn.

## **—Canvas (Stitched)**

McIlroy Belting & Hose Co., Hammond, Ind.  
Manheim Mfg. & Belting Co., Manheim, Pa.

Mount Vernon Belting Co., 327-333 Warren Ave., Baltimore, Md.

National Leather Belting Co., 342 E. 38th St., New York

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Ruboil Belting Co., 8th & Wallace Sts., Philadelphia, Pa.

Sawyer Belting Co., Cleveland, O.  
Victor Balata & Textile Belting Co., 38 Murray St., New York

## **—Chain Link**

(See Chain Belts and Links)

## **—Conveyor**

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Burrell Belting Co., 413-417 S. Hermitage Ave., Chicago, Ill.

Dick, Ltd., R. & J., Passaic, N. J.

\*GOODRICH CO., B. F., Akron, O. *pp. 149, 200*

Hamilton Rubber Mfg. Co., Trenton, N. J.

Hettrick Mfg. Co., Toledo, O.  
LAMSON CO., 100 Boylston St., Boston, Mass. *pp. 210, 211*

Manheim Mfg. & Belting Co., Manheim, Pa.  
Mount Vernon Belting Co., 327-333 Warren Ave., Baltimore, Md.

New York Belting & Packing Co., 91-93 Chambers St., New York

NEW YORK RUBBER CO., 34 Reade St., New York. *pp. 198, 199*

Paulus & Co., Jos. C., 2507-11 Potter St., Philadelphia, Pa.

Peerless Rubber Mfg. Co., 31 Warren St., New York

Quaker City Rubber Co., 629 Market St., Philadelphia, Pa.

Republic Rubber Co., Youngstown, O.  
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Ruboil Belting Co., 8th & Wallace Sts., Philadelphia, Pa.

Scandinavia Belting Co., 106-108 Reade St., New York

Stanley Belting Corp'n, 40 S. Clinton St., Chicago, Ill.

Victor Balata & Textile Belting Co., 38 Murray St., New York

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## **—Cotton**

Acme Belting Co., Niles, Mich.  
Cleveland Fabric Belting Co., 1473 W. 110th St., Cleveland, O.

McIlroy Belting & Hose Co., Hammond, Ind.  
Nott Co., W. S., 201-211 N. Third St., Minneapolis, Minn.

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## **—Cotton-Leather**

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## **—Endless**

Acme Belting Co., Niles, Mich.  
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RHOADS & SONS, J. E., 12 N. Third St., Philadelphia, Pa. *pp. 194, 195*

Scandinavia Belting Co., 106-108 Reade St., New York

## **—Fabric**

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Cleveland Fabric Belting Co., 1473 W. 110th St., Cleveland, O.

Fabrecka Belting Co., Burlington, Vt.

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Stanley Belting Corp'n, 40 S. Clinton St., Chicago, Ill.

## **—Fabric (Leather Faced)**

Peerless Belting Co., Gardenville Station, Buffalo, N. Y.

## **—Hair**

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Scandinavia Belting Co., 106-108 Reade St., New York

## **—Leather**

Albany Belting & Supply Co., 372 Broadway Albany, N. Y.

Bel

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- Alexander Bros., 414 N. 3rd St., Philadelphia, Pa.  
 American Belting & Tanning Co., 135 Oliver St., Boston, Mass.  
 Barnes Co., Henry K., 234 Devonshire St., Boston, Mass.  
 Bay State Belting Co., 605 Atlantic Ave., Boston, Mass.  
 Bickford & Francis Belting Co., Buffalo, N. Y.  
 BOND CO., CHARLES, 520 Arch St., Philadelphia, Pa. *p. 174*  
 Bonner & Barnwall, Inc., 30 Church St., New York  
 Bradford Belting Co., 202 Walnut St., Cincinnati, O.  
 Central Belting Co., 151 Lafayette St., N. Y.  
 Chicago Belting Co., 113 N. Green St., Chicago, Ill.  
 Coe & Brown Co., New Haven, Conn.  
 Consolidated Belting Co., 2 Jeffrey St., Chester, Pa.  
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 Cousé & Bolten, 42 Lafayette St., Newark, N. J.  
 Covell Belting Co., 41 N. 7th St., Philadelphia, Pa.  
 Cowan & Co., Andrew, Louisville, Ky.  
 Cross Bros. & Co., 112-114 Mill St., Rochester, N. Y.  
 Detroit Oak Belting Co., Detroit, Mich.  
 Druid Oak Belting Co., Inc., 111 E. Lombard St., Baltimore, Md.  
 Eagle Counter & Leather Co., 414 E. 8th St., Cincinnati, O.  
 Etsweiler Co., William, 230 N. 3rd St., Philadelphia, Pa.  
 Evansville Leather & Belting Co., 429 Sycamore St., Evansville, Ind.  
 Forster Co., John M., 110 Mill St., Rochester, N. Y.  
 Gandy Belting Co., 726-740 W. Pratt St., Baltimore, Md.  
 Grand Rapids Belting Co., 1-3 Ionia Ave., Grand Rapids, Mich.  
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 Himmelein & Bailey, 248 Chestnut St., Philadelphia, Pa.  
 Holyoke Belting Co., 66-68 Winter St., Holyoke, Mass.  
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 Houghton & Co., E. F., 240 W. Somerset St., Philadelphia, Pa.  
 Hudson Belting Co., Worcester, Mass.  
 Ireson, Charles L., 221 High St., Boston, Mass.  
 Jewell Belting Co., Hartford, Conn.  
 Johnson Belting Co., 342 E. 38th St., New York  
 Ladew Co., Inc., Edward R., Glen Cove, N. Y.  
 Lawrence Belting Co., 111 Chambers St., New York  
 McCauley Belting Co., 412-420 Orleans St., Chicago, Ill.  
 MacWatty Belting Co., 7 Beverly St., Providence, R. I.  
 Meier-Andres Belting Co., 301 Market St., Newark N. J.  
 Missouri Belting Co., 1021-29 S. Grand Ave., St. Louis, Mo.  
 Moloney Belting Co., Chicago, Ill.  
 Mooney Belting Co., Cincinnati, O.  
 National Leather Belting Co., 342 E. 38th St., New York  
 New York Leather Belting Co., 465 Kent Ave., Brooklyn, N. Y.  
 Norwich Belting Co., Norwich, Conn.  
 Nott Co., W. S., 201-211 N. Third St., Minneapolis, Minn.  
 Olmsted-Flint Co., Cambridge, Mass.  
 Page Belting Co., Concord, N. H.  
 Palmer & Co., N., Bridgeport, Conn.  
 Paulus & Co., Jos. C., 2507-11 Potter St., Philadelphia, Pa.  
 Philadelphia Belting Co., Sixth & Spring Garden Sts., Philadelphia, Pa.  
 Rahmann & Co., G., 31 Spruce St., New York  
 Raniville Co., F., Grand Rapids, Mich.  
 Reed & Duecker, Memphis, Tenn.  
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 Richie Crawford Co., 406 N. 3rd St., Philadelphia, Pa.  
 Rockford Belting Co., Rockford, Ill.  
 Salisbury & Co., W. H., 308-310 W. Madison St., Chicago, Ill.  
 Schackley & Son Co., W. T., 49 High St., Boston, Mass.  
 \*SCHIEREN CO., CHAS. A., 30-38 Ferry St., New York. *p. 193*  
 Schwartz Belting Co., 76 Murray St., New York  
 SHULTZ BELTING CO., 402 Barton St., St. Louis, Mo. *p. 196*  
 Sikes Co., S. R., Cor. 11th Ave., So., & 3rd St., Minneapolis, Minn.  
 Smyth-Despard Co., Broad & John Sts., Utica, N. Y.  
 Southern Belting Co., Atlanta, Ga.  
 Strong & Hery Co., 301-307 State St., Rochester, N. Y.  
 Turner Mfg. Co., J. S., 133 Middle St., Lowell, Mass.  
 Ulmer Leather Co., Norwich, Conn.  
 Union Belt Co., Fall River, Mass.  
 Walker's Sons & Co., Chas. W., 288 Market St., Newark, N. J.  
 Warren Co., J. F. & W. H., Worcester, Mass.  
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 Western Rawhide & Belting Co., 7th Ave. & S. Pierce St., Milwaukee, Wis.  
 Whiting, Henry F., Lowell, Mass.  
 Williams & Sons, I. B., 9 Orchard St., Dover, N. H.  
**—Rawhide**  
 Etsweiler Co., William, 230 N. 3rd St., Philadelphia, Pa.  
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 Williams & Sons, I. B., 9 Orchard St., Dover, N. H.  
**—Round (Twist)**  
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 Bowers Rubber Works, 68 Sacramento St., San Francisco, Cal.  
 Cincinnati Rubber Mfg. Co., Cincinnati, O.  
 Consumers Rubber Co., 829 Superior Ave., Cleveland, O.  
 Empire Rubber & Tire Co., Trenton, N. J.  
 \*GOODRICH CO., B. F., Akron, O. *pp. 149, 200*  
 Goodyear Tire & Rubber Co., Akron, O.  
 Gutta Percha & Rubber Mfg. Co., 126-128 Duane St., New York  
 Hamilton Rubber Mfg. Co., Trenton, N. J.  
 Maguire Rubber Co., 30 Church St., New York  
 Mechanical Rubber Co., Chicago, Ill.

Bel

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Manhattan Rubber Mfg. Co., 61 Willett St., Passaic, N. J.  
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 New York Belting & Packing Co., 91-93 Chambers St., New York  
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 Quaker City Rubber Co., 629 Market St., Philadelphia, Pa.  
 Revere Rubber Co., Chelsea, Mass.  
 Schultz Patent Rubber Co., 1239 Summer St., Philadelphia, Pa.  
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## —Waterproof

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 Barnes Co., Henry K., 234 Devonshire St., Boston, Mass.  
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 Central Belting Co., 151 Lafayette St., New York  
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 Conse & Bolten, 42 Lafayette St., Newark, N. J.  
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 Dick, Ltd., R. & J., Passaic, N. J.  
 Druid Oak Belting Co., Inc., 111 E. Lombard St., Baltimore, Md.  
 Eagle Counter & Leather Co., 414 E. 8th St., Cincinnati, O.  
 Etsweiler Co., William, 230 N. 3rd St., Philadelphia, Pa.  
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 Holyoke Belting Co., 66-68 Winter St., Holyoke, Mass.  
 Lawrence Belting Co., 111 Chambers St., New York  
 McCauley Belting Co., 412-420 Orleans St., Chicago, Ill.  
 Meier-Andres Belting Co., 301 Market St., Newark, N. J.  
 Mooney Belting Co., Cincinnati, O.  
 Olmsted-Flint Co., Cambridge, Mass.  
 Paulus & Co., Jos. C., 2507-11 Potter St., Philadelphia, Pa.  
 Peerless Belting Co., Gardenville Station, Buffalo, N. Y.  
 Philadelphia Belting Co., Sixth & Spring Garden Sts., Philadelphia, Pa.  
 Rahmann & Co., G., 31 Spruce St., New York  
 Reed & Ducker, Memphis, Tenn.  
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Salisbury & Co., W. H., 308-310 W. Madison St., Chicago, Ill.

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Garwood Bronze & Iron Works, Garwood, N. J.

\*HILL CLUTCH CO., Cleveland, O. *p. 170*

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TORRINGTON MFG. CO., Torrington, Conn. *p. 374*

WATSON-STILLMAN CO., 35 Church St., New York. *p. 362*

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\*WOOD & CO., R. D., Philadelphia, Pa. *pp. 360, 361*

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 Parks Co., G. M., Fitchburg, Mass.  
 \*PITTSBURGH VALVE, FOUNDRY & CONST. CO., Pittsburgh, Pa. .pp. 116, 117  
 Simmons Pipe Bending Works, 41 Mechanic St., Newark, N. J.  
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 Whitaker-Glessner Co., Wheeling, W. Va.

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 Pittsburgh Steel Co., Union Arcade Bldg., Pittsburgh, Pa.  
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 Wood Iron & Steel Co., Alan, Widener Bldg., Philadelphia, Pa.

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America Hoist & Derrick Co., St. Paul, Minn.  
 \*CLYDE IRON WORKS, 29th Ave., W., & Michigan St., Duluth, Minn. .p. 219

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\*GENERAL ELECTRIC CO., Schenectady, N. Y. .pp. 20, 21, 406

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Bically Fan Co., 866 Prospect Ave., Buffalo, N. Y.

Clarage Fan Co., Kalamazoo, Mich.

Columbus Heating & Ventilating Co., Columbus, O.

Coppus Engineering & Equipment Co., 344 Park Ave., Worcester, Mass.

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\*GREEN FUEL ECONOMIZER CO., 90 West St., New York. .p. 64

Ilg Electric Ventilating Co., 154 Whiting St., Chicago, Ill.

Indiana Fan Co., 40 E. South St., Indianapolis, Ind.

New England Ventilating & Heating Co., Providence, R. I.

New York Blower Co., Archer Ave. & Canal St., Chicago, Ill.

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Western Blower Co., 1800 9th Ave., South, Seattle, Wash.

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Clothel Co., 61 Broadway, New York

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Lebrun Co., Mascher & Turner Sts., Philadelphia, Pa.

Nelson Blower & Furnace Co., 11 Elkins St., Boston, Mass.

Organ Power Co., 618-620 Capitol Ave., Hartford, Conn.

Piqua Blower Co., Piqua, O.

Power Engineering Co., Railway Exchange, Chicago, Ill.

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Beach-Russ Co., 220 Broadway, New York

Buffalo Dental Mfg. Co., 587-589 Main St., Buffalo, N. Y.

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Ironton Punch & Shear Co., Ironton, O.

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Roots Co., P. H. & F. M., Connersville, Ind.

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 Diamond Power Specialty Co., 80 First St., Detroit, Mich.  
 Hafer Foundry & Machine Works, Chambersburg, Pa.  
 Huyette Co., Paul B., 18th & Market Sts., Philadelphia, Pa.  
 Marion Machine, Foundry & Supply Co., Marion, Ind.  
 Monarch Steam Blower Co., Troy, N. Y.  
 National Boiler Specialties Co., Elgin, Ill.  
 Sherwood Mfg. Co., Buffalo, N. Y.  
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 Schutte & Koerting Co., 12th & Thompson Sts., Philadelphia, Pa.  
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**DRY DOCK MACHINERY**

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Galland-Henning Mfg. Co., Milwaukee, Wis.

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Grupe Drier & Boiler Co., 325-331 E. Second St., Davenport, Ia.

General Reduction, Gas & By-Products Co., 49 Wall St., New York

Hersey Mfg. Co., South Boston, Mass.

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 Buffalo Foundry & Machine Co., E. Perry St. & Fillmore Ave., Buffalo, N. Y.  
 Devine Co., J. P., 1372 Clinton St., Buffalo, N. Y.

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 Bates Elevator Co., 211 President St., Baltimore, Md.

General Elevator Co., 29 Broadway, New York

McLauthlin Co., Geo. T., 120 Fulton St., Boston, Mass.

Roberts Elevator Co., James H., 430 W. Broadway, New York

Speidel, J. G., Reading, Pa.

Storm Mfg. Co., 50 Vesey St., Newark, N. J.

—**Hand Power**  
 Speidel, J. G., Reading, Pa.

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 Standard Plunger Elevator Co., 243 Stafford St., Worcester, Mass.

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 Clark Dust Collecting Co., Fisher Bldg., Chicago, Ill.

Cleveland Blow Pipe & Mfg. Co., 6302 Kinsman Road, Cleveland, O.

Dixie Mfg. Co., Inc., Russell St. & B. & O. R. R., Baltimore, Md.

Meadon's Blower & Pipe Works, 23-27 Meserole Ave., Brooklyn, N. Y.

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Meadon's Blower & Pipe Works, 23-27 Meserole Ave., Brooklyn, N. Y.

National Blow Pipe & Mfg. Co., Ltd., New Orleans, La.

Pangborn Corp'n, Hagerstown, Md.

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Illinois Mfg. & Supply Co., Quincy, Ill.

—**Metal**  
 Allington & Curtis Mfg. Co., 400 Holden St., Saginaw, Mich.

Clark Dust Collecting Co., Fisher Bldg., Chicago, Ill.

Cleveland Blow Pipe & Mfg. Co., 6302 Kinsman Road, Cleveland, O.

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Townsend Furnace & Machine Shop Co., Broadway & Rensselaer St., Albany, N. Y.

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Standard Motor Construction Co., 174 Whiton St., Jersey City, N. J.

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Simplex Ejector Co., 1050 Randolph St., Chicago, Ill.

Twinvolute Pump &amp; Mfg. Co., 216-228 High St.,

Newark, N. J.

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Kimble Electric Co., 634 N. Western Ave.,

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Kamman Mfg. Co., Walter, 3264 Spring Grove

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Bates Elevator Co., 21 President St., Baltimore,

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Eastern Machinery Co., New Haven, Conn.

General Elevator Co., 29 Broadway, New York

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Keystone Steel Castings Co., Chester, Pa.

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**Angola Gas Engine Co.**, Angola, Ind.  
**Augustine Automatic Rotary Engine Co.**, 1862 Elmwood Ave., Buffalo, N. Y.  
**Backus Water Motor Co.**, 172-182 Pennsylvania Ave., Newark, N. J.  
**Benninghofen Sons, C.**, Hamilton, O.  
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**Meriam Co.**, 1514 Prospect Ave., Cleveland, O.  
**Mesta Machine Co.**, Box 1124, Pittsburgh, Pa.  
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**Associated Mfg. Co.**, Waterloo, Ia.  
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**Blount Engineering Co.**, 100 High St., Boston, Mass.

**Bond Co.**, Harold L., 383-391 Atlantic Ave., Boston, Mass.

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 Anderson Engine Co., 4036 N. Rockwell St., Chicago, Ill.  
 Baltimore Oil Engine Co., P. O. B. 100 Highlandtown, Baltimore, Md.  
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 Fay & Bowen Engine Co., Geneva, N. Y.  
 Ferro Machine & Foundry Co., Cleveland, O.  
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Champion Tool Works Co., 2422 Spring Grove Ave., Cincinnati, O.

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 Mann, Chas. A., 166 Doyle Ave., Providence,  
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 Monarch Machine Tool Co., Sidney, O.  
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 Mueller Machine Tool Co., 2425 Colerain Ave.,  
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 Springfield Machine Tool Co., Springfield, O.  
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 Ohio  
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**METALLOGRAPHIC APPARATUS**

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Holz, Herman A., 1 Madison Ave., New York

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Cross Engineering Co., Carbondale, Pa.

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Harrington &amp; King Perforating Co., 629 N. Union Ave., Chicago, Ill.

Hendrick Mfg. Co., Carbondale, Pa.

Manhattan Perforated Metal Co., 237 Centre St., New York

Mundt &amp; Sons, Charles, 53-65 Fairmount Ave., Jersey City, N. J.

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Empire Metal Co., Syracuse, N. Y.

Imperial Type Metal Co., Philadelphia, Pa.

Leddell Metals Co., Inc., 281 Borden Ave., Long Island City, N. Y.

Murphy Metals Co., 818 Webster Bldg., Chicago, Ill.

Pittsburgh White Metal Co., 160 Leroy St., New York

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Meriam Co., 1514 Prospect Ave., Cleveland, O.

New Jersey Meter Co., Plainfield, N. J.

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Sargent Steam Meter Co., 2835-37 Armitage Ave., Chicago, Ill.

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**Bausch & Lomb Optical Co.**, Rochester, N. Y.

**MILK BOTTLE'S MACHINERY**

**Rice & Adams Corp'n**, Buffalo, N. Y.

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**MILK CAN WASHING MACHINES**

**Dairy Machinery & Construction Co.**, Derby, Conn.

**Hershey Machine & Foundry Co.**, Manheim, Pa.

**MILL WEARING PARTS (Ball, Stamp and Tube)**

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Fischer Machine Co., 310-316 N. 11th St., Philadelphia, Pa.  
 National Machine Tool Co., 2272 Spring Grove Ave., Cincinnati, O.

**—Plain**

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Pedrick Tool & Machine Co., 3642 N. Lawrence St., Philadelphia, Pa.  
 Rooksby & Co., E. J., 435 N. Eleventh St., Philadelphia, Pa.

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 Waltham Machine Works, Waltham, Mass.

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 Munson Mill Machinery Co., Inc., 405 Broadway, Utica, N. Y.

**—Ball**

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 Braddock Mfg. Co., Braddock, Pa.  
 Chalmers & Williams, Chicago Heights, Ill.  
 Hardinge Conical Mill Co., 120 Broadway, New York  
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 Sly Mfg. Co., W. W., Cleveland, O.  
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Munson Mill Machinery Co., Inc., 405 Broadway, Utica, N. Y.

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—**Pebble**  
Hardinge Conical Mill Co., 120 Broadway, New York  
Patterson Foundry & Machine Co., East Liverpool, O.

—**Roller**  
Acton, John, 118 John St., Brooklyn, N. Y.  
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Frost Mfg. Co., Galesburg, Ill.

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Robert A. Keasbey Co., 445 West St., New York

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United Iron Works Co., Springfield, Mo.

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Angels Iron Works, Angels Camp, Cal.  
Bretting Mfg. Co., C. G., Ashland, Wis.  
Castle Engineering Co., Inc., A. M., La Crosse, Wis.  
Colorado Iron Works, Co., Box 989, Denver, Colo.  
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Mecklenburg Iron Works, Charlotte, N. C.  
Myers-Whaley Co., Knoxville, Tenn.  
Nelsonville Foundry & Machine Co., Nelsonville, O.  
\*POOLE ENGINEERING & MACHINE CO., Woodberry, Baltimore, Md., pp. 158, 159  
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Ransome Concrete Machinery Co., 115 Broadway, New York  
Walker & Ellicott, Wilmington, Del.  
\*WILLIAMS PATENT CRUSHER & PULVERIZER CO., Old Colony Bldg., Chicago, Ill., pp. 370, 371

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Austin Drainage Excavator Co., F. C., 609-80 E. Jackson St., Chicago, Ill.  
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Shannon & Co., J. Jacob, 1744 Market St., Philadelphia, Pa.  
Standard Scale & Supply Co., 1631 Liberty Ave., Pittsburgh, Pa.  
United Engine Co., Lansing, Mich.

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Ross & Son Co., Chas., 148-156 Classon Ave., Brooklyn, N. Y.

—**Foundry Sand**  
Sand Mixing Machine Co., 52 Vanderbilt Ave., New York  
Standard Sand & Machine Co., Cleveland, O.

—**Gas and Air**  
Kemp Mfg. Co., C. M., Baltimore, Md.

**MOLDING MACHINES**  
Arcade Mfg. Co., Freeport, Ill.  
B & B Mfg. Co., Inc., Indianapolis, Ind.  
Berkshire Mfg. Co., Cleveland, O.  
Midland Machine Co., 811 W. Jefferson Ave., Detroit, Mich.  
Mumford Co., E. H., Elizabeth, N. J.  
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, O.  
Tabor Mfg. Co., 18th & Hamilton Sts., Philadelphia, Pa.  
U. S. Molding Machine Co., 968 E. 69th Place, Cleveland, Ohio

—**Hand and Jar Rammed Bollover**  
Midland Machine Co., 811 W. Jefferson Ave., Detroit, Mich.

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—**Ingot**  
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Goshen Rubber & Mfg. Co., Goshen, Ind.  
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 Langstadt Meyer Co., Appleton, Wis.  
 Peerless Electric Co., Warren, O.  
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 \*WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., pp. 96, 97

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 Roberts Motor Mfg. Co., Sandusky, O.  
 Wright-Martin Aircraft Co., New Brunswick, N. J.

**—Air and Steam**

Union Machine Co., 183 University Ave., St. Paul, Minn.

**—Automobile**

Davis Mfg. Co., Milwaukee, Wis.  
 Duesenberg Motors Corp'n, 120 Broadway, New York  
 Elbridge Engine Co., 328 Main St., E., Rochester, N. Y.  
 Falls Motors Corp'n, Sheboygan Falls, Wis.  
 Ferro Machine & Foundry Co., Cleveland, O.  
 Hercules Motor Mfg. Co., Canton, O.  
 Heschell Spillman Co., North Tonawanda, N. Y.  
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 Diehl Mfg. Co., Elizabethport, N. J.  
 Dienelt & Eisenhardt, Inc., 1304 N. Howard St., Philadelphia, Pa.  
 Eck Dynamo & Motor Co., Belleville, N. J.  
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 Kester Electric Co., Terre Haute, Ind.  
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 Lincoln Electric Co., Kelly Ave. & 38th St., Cleveland, O.  
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France Packing Co., Tacony, Philadelphia, Pa.

Goetze Gasket & Packing Co., P. O. Box 176, New Brunswick, N. J.

Harper Mfg. Co., Chester, Pa.

High-Speed Metallic Packing Co., 305 N. Michigan Ave., Chicago, Ill.

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Standard Engineering Co., Ellwood City, Pa.  
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Mitchell & Co., W. K., Ellsworth St. & Schuyl-  
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 Sly Mfg. Co., W. W., Cleveland, O.  
 Tilghman-Brookshank Sand Blast Co., 1126 S. Eleventh St., Philadelphia, Pa.

**SAND BLAST ROOMS**

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 MacLeod Co., Bogen St., Cincinnati, Ohio  
 Mott Sand & Blast Mfg. Co., Inc., 2-8 Frost St., Brooklyn, N. Y.  
 Tilghman-Brookshank Sand Blast Co., 1126 S. Eleventh St., Philadelphia, Pa.

**SAND CUTTING MACHINERY**

Sand Mixing Machine Co., 52 Vanderbilt Ave., New York

**SAND MAKING MACHINERY**

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**SASH OPERATING DEVICES**

Bayley Co., William, Springfield, O.  
 Detroit Steel Products Co., 2250 E. Grand Blvd., Detroit, Mich.  
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Ferry Cap & Set Screw Co., 2151 Scranton Road, Cleveland, O.  
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Cincinnati Shaper Co., Cincinnati, O.

Cochrane-Bly Co., Rochester, N. Y.

Davis Machine Tool Co., Inc., 305 St. Paul St., Rochester, N. Y.

Gould & Eberhardt, Newark, N. J.

Hendey Machine Co., Torrington, Conn.

Hollingsworth Machine Tool Co., 2nd & Greenup Sts., Covington, Ky.

Milwaukee Shaper & Transmission Appliance Co., 1148-50 Holton St., Milwaukee, Wis.

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Cleveland Blow Pipe & Mfg. Co., 6302 Kinsman Road, Cleveland, O.  
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Cleveland Metal Products Co., 7609 Platt Ave., Cleveland, O.

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 Babson-Dow Mfg. Co., 60 Fulda St., Roxbury, Boston, Mass.  
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Nilson Machine Co., A. H., 1525 Railroad Ave., Bridgeport, Conn.

Nilson-Miller Co., 1300 Hudson St., Hoboken, N. J.

Pittsburgh Instrument & Machine Co., 101 Water St., Pittsburgh, Pa.

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 Redington & Co., F. B., 112 S. Sangamon St., Chicago, Ill.

Richard Mfg. Co., Bloomburg, Pa.  
 Richmond Metal Products Co., Inc., 5th & Arch Sts., Richmond, Va.

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Russel Wheel & Foundry Co., Detroit, Mich.  
 Sanford Mfg. Co., F. C., Bridgeport, Conn.

Sheffield Machine & Tool Co., Dayton, O.  
 Shepherd Engineering Co., Williamsport, Pa.

Sigourney Tool Co., 9 Sigourney St., Hartford, Conn.

SLOAN & CHACE MFG. CO., LTD., Sixth Ave., Cor. N. 13th St., Newark, N. J. . . *p. 284*

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Turley Gear & Machine Co., 1505 N. 10th St., St. Louis, Mo.

Turner-Fricke Mfg. Co., Pittsburgh, Pa.  
 Varick Engineering & Machine Wks., Johnson & Varick Aves., Brooklyn, N. Y.

Walker Bros. Co., 227 Walton St., Syracuse, N. Y.

Walsh Press & Die Co., 4709 W. Kinzie St., Chicago, Ill.

Waltham Machine Works, Waltham, Mass.  
 Watertown Engine & Machine Co., Watertown, N. Y.

Webster & Perks Tool Co., Springfield, O.  
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 York Electric & Machine Co., 30-34 N. Penn St., York, Pa.

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**SPIKE MACHINES**

Youngstown Foundry, Youngstown, O.

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Union Spring & Mfg. Co., 1207 Fulton Bldg., Pittsburgh, Pa.

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Barnes Co., Wallace, Main St., Bristol, Conn.  
Cook Spring Co., 420 E. 106th St., New York  
New York Wire & Spring Co., 586 Washington St., New York

**—Machinery**

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Miller Wire Spring Co., Bridgeport, Conn.  
New York Wire & Spring Co., 586 Washington St., New York

Pittsburgh Spring & Steel Co., 1417 Farmers Bank Bldg., Pittsburgh, Pa.

**—Vanadium**

Barnes Co., Wallace, Main St., Bristol, Conn.  
Cook Spring Co., 420 E. 106th St., New York  
New York Wire & Spring Co., 586 Washington St., New York

Raymond Mfg. Co., Ltd., Corry, Pa.

**—Vehicle (Flat Leaf)**

Hess Spring & Axle Co., 124 W. 66th St., Carthage, Cincinnati, O.  
Sheldon Axle & Spring Co., Wilkes-Barre, Pa.  
Standard Parts Co., Cleveland, O.

**—Wire**

Barnes Co., Wallace, Main St., Bristol, Conn.  
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Miller Wire Spring Co., Bridgeport, Conn.  
New York Wire Spring Co., 586 Washington St., New York

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**SPRINKLER SYSTEMS, FIRE (Automatic)**

Globe Automatic Sprinkler Co., 2035 Washington Ave., Philadelphia, Pa.

Rockwood Sprinkler Co. of Mass., 34-56 Harlow St., Worcester, Mass.

**SPRINKLERS****—Automatic**

Automatic Sprinkler Co. of America, 123 William St., New York

Foskett & Bishop Co., New Haven, Conn.

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 McAleenan Bros. Co., 25th & R. R. Sts., Pittsburgh, Pa.  
 McDermott Engineering Co., Whitehall & Jordan Sts., Allentown, Pa.  
 McNaull Boiler Mfg. Co., Toledo, O.  
 Meehan Boiler & Construction Co., Lowellville, O.  
 Michelmann Steel Construction Co., 121-141 N. Second St., Quincy, Ill.  
 Milwaukee Boiler Co., 220 Oregon St., Milwaukee, Wis.  
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 New York Central Iron Works Co., Box 66, Hagerstown, Md.  
 O'Brien Boiler Works Co., John, St. Louis, Mo.  
 Ohio Machine & Boiler Co., 1503 University St., Cleveland, O.  
 Oswego Boiler & Engine Co., Oswego, N. Y.  
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 Bridgeport Brass Co., Bridgeport, Conn.  
 Bridgeport Metal Goods Mfg. Co., Cherry St., Bridgeport, Conn.  
 Cleveland Metal Products Co., 7609 Platt Ave., Cleveland, O.  
 Cleveland Wrought Products Co., Cleveland, O.  
 Craig Mfg. Co., Cedar Rapids, Iowa  
 Gasket Supply Co., 1708 Ludlow St., Philadelphia, Pa.  
 Gem Mfg. Co., 1229-43 Goebel St., N. S., Pittsburgh, Pa.  
 Gem Stopper Co., 2120 Nicholas St., Philadelphia, Pa.  
 Geuder, Paeschke & Frey Co., 1351 St. Paul Ave., Milwaukee, Wis.  
 Globe Machine & Stamping Co., 1254 W. 76th St., N. W., Cleveland, O.  
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 McKinney Mfg. Co., Pittsburgh, Pa.  
 Mason Machine Co., Inc., Jos. M., 2305 N. Marshall St., Philadelphia, Pa.  
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 Miller Wire Spring Co., Bridgeport, Conn.  
 Mossberg Co., Frank, Attleboro, Mass.  
 Owen & Co., E. H., 101 N. Jefferson St., Chicago, Ill.  
 Ramsdell Specialty Co., W. Boylston St., Worcester, Mass.  
 Robinson Tool Works, Inc., Waterbury, Conn.  
 Root Co., C. J., Bristol, Conn.  
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#### STARCH MAKING MACHINERY

Remmers & Sons, B., 1227 Germantown Ave., Philadelphia, Pa.

#### STAYBOLTS

Falls Hollow Staybolt Co., 21 E. Portage St., Cuyahoga Falls, O.  
 Flannery Bolt Co., Vanadium Bldg., Pittsburgh, Pa.

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Watson & McDaniel Co., 142 N. 7th St., Phila-  
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Wilcox Mfg. Co., E. A., Chicago, Ill.

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Apex Steel Corp'n, 50 Church St., New York  
Atlas Crucible Steel Co., Dunkirk, N. Y.  
Becker Steel Co. of America, Inc., 90 West St.,  
New York  
Carbon Steel Co., P. O. Box 1591, Pittsburgh,  
Pa.  
Carpenter Steel Co., Reading, Pa.  
Colonial Steel Co., 324 4th Ave., Pittsburgh,  
Pa.  
Denman & Davis, 93-99 Lafayette St., New  
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Fairley-Davidson Steel Co., Inc., 124 Maiden  
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Denman & Davis, 93-99 Lafayette St., New  
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Atlas Crucible Steel Co., Dunkirk, N. Y.  
Becker Steel Co. of America, Inc., 90 West St.,  
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Century Steel Co. of America, 120 Broadway,  
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Colonial Steel Co., 324 4th Ave., Pittsburgh,  
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Cyclops Steel Co., 120 Broadway, New York  
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**Becker Steel Co. of America, Inc.**, 90 West St., New York  
**Carpenter Steel Co.**, Reading, Pa.  
**Century Steel Co. of America**, 120 Broadway, New York  
**Colonial Steel Co.**, 324 4th Ave., Pittsburgh, Pa.  
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**Johnson & Barry Steel Co., Inc.**, Birmingham, Ala.  
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**Lookout Boiler & Mfg. Co.**, Chattanooga, Tenn.  
**McAleenan Bros. Co.**, 25th & R. R. Sts., Pittsburgh, Pa.  
**McClintic-Marshall Co.**, 1217 Oliver Bldg., Pittsburgh, Pa.  
**McNeil & Bros. Co.**, James, 29th St. & A. V. R. R., Pittsburgh, Pa.  
**MacKinnon Boiler & Machine Co.**, 218-230 N. Water St., Bay City, Mich.  
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**Muskegon Boiler Works**, Muskegon, Mich.  
**New Haven Boiler Works**, Mill St., New Haven, Conn.  
**New York Central Iron Works Co.**, Box 66, Hagerstown, Md.  
**Nichols Iron Works, Inc.**, D. M., 2-4 Governor Slip, New York  
**Ohio Machine & Boiler Co.**, 1503 University St., Cleveland, O.  
**Petroleum Iron Works Co.**, Sharon, Pa.  
**PHOENIX IRON WORKS CO.**, Meadville, Pa... p. 382  
**Pickham Boiler Co.**, 3035 W. Jackson Blvd., Chicago, Ill.  
**Pollock Co.**, Wm. B., Youngstown, O.  
**Prospect Boiler Co.**, Codruse Ave. & Power St., New Brunswick, N. J.  
**Riter-Conley Co.**, Pittsburgh, Pa.

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 Smith & Son Co., Samuel, 130-150 Railroad Ave., Paterson, N. J.  
 Standard Boiler & Plate Iron Co., Niles, O.  
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 Treadwell Const. Co., Midland, Pa.  
 Turl Iron & Car Co., Inc., 50 Board St., New York  
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 Whitehead & Kales Iron Works, Beecher Ave. & M. C. R. R., Detroit, Mich.

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Borden Co., Warren, O.

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\*CRANE CO., 836 S. Michigan Ave., Chicago, Ill. . . *pp. 104, 105, 106, 107*

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Brady Foundry Co., James A., 45th St. & Western Blvd., Chicago, Ill.

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Crowe, Paul L., 33 Bidwell Ave., Jersey City, N. J.

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Laclede-Christy Clay Products Co., 5900 Manchester Ave., St. Louis, Mo.

Manistee Iron Works Co., Manistee, Mich.

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Kokomo Foundry & Machine Co., Kokomo, Ind.

Moloch Stoker Co., Room 776, 208 S. La Salle St., Chicago, Ill.

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Seidel, Inc., R. B., 1322 Callowhill St., Philadelphia, Pa.

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Bridgeport Boiler Works Co., Bridgeport, Conn.

Gifford-Wood Co., Hudson, N. Y.

Guarantee Construction Co., 90 West St., New York

Hendrick Mfg. Co., Carbondale, Pa.

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McClintic-Marshall Co., 1217 Oliver Bldg., Pittsburgh, Pa.

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Pyne Co., 927 Rupp St., Louisville, Ky.

Red Wing Iron Works, Red Wing, Minn.

Russel Wheel & Foundry Co., Detroit, Mich.

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Vulcan Iron Works, 1849 Kearny St., San Francisco, Cal.

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**SWITCHBOARDS**

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Frost Engineering Co., Evansville, Wis.

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Detroit Fuse & Mfg. Co., Detroit, Mich.

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**Imperial Machinery Co.**, 1611 Central Ave., Minneapolis, Minn.  
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**Minneapolis Steel & Machinery Co.**, 29th & Minnehaha Ave., Minneapolis, Minn.  
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Strong, Carlisle & Hammond Co., Cleveland, O.

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Lewis-Shepard Co., 48 Binford St., Boston, Mass.  
National Scale Co., Chicopee Falls, Mass.  
Plimpton Elevating Truck, 70 Fifth Ave., New York  
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Transmission Ball Bearing Co., Inc., 1050 Military Road, Buffalo, N. Y.

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Liberty Mfg. Co., 6900 Susquehanna St., Pittsburgh, Pa.  
Manchester Mfg. Co., North Manchester, Ind.  
Monarch Steam Blower Co., Troy, N. Y.  
National Boiler Specialties Co., Elgin, Ill.  
Pierce Co., Wm. B., 45 North Division St., Buffalo, N. Y.

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Roto Co., P. O. Box 1043, Hartford, Conn.  
Sherwood Mfg. Co., Buffalo, N. Y.  
Spencer Turbine Cleaner Co., Hartford, Conn.  
Thompson & Co., Richard, 126 Liberty St., New York

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 Morton Vacuum Breaker Co., Hyde Park, Boston, Mass.

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 Blaisdell Machinery Co., Bradford, Pa.  
 Monarch Vacuum Specialties Corp'n, 1161-1175 Broadway, New York  
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**VACUUM DRYING APPARATUS**

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**VALVE CHESTS, UNIVERSAL (Locomotive)**

Economy Devices Corp'n, 30 Church St., New York

**VALVE CUPS**

Schenck Mfg. & Supply Co., Parkers Landing, Pa.

**VALVE FINISHING MACHINES (Globe)**

Pottstown Machine Co., Pottstown, Pa.

**VALVE RESEATING MACHINES**

Leavitt Machine Co., Orange, Mass.

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National Steam Specialty Co., 12 S. Clinton St., Chicago, Ill.

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Ohio Injector Co., S. Main St., Wadsworth, O.

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**Lawrence & Co., L.**, 290 Halsey St., Newark, N. J.  
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**Henderson-Willis Welding & Cutting Co.**, 2305-07-09 N. 11th St., St. Louis, Mo.  
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Indestructible Wheel Co., Lebanon, Ind.  
Wheel Co. of America, Inc., P. T., P. O. Box 574, Dayton, O.  
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